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AN-862300

Energy Monitoring with ComView

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Applicable Products: ComView NX(L/X)

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Introduction

ComView offers a suite of user applications. Energy app is one of the add-on applications that helps users simplify their tasks in energy consumption management.

Energy app lets users read power and energy measurements from power meters, perform calculations on these readings, log and monitor these values for alarm conditions based on thresholds, and analyze energy consumption trends with reports and data visualizations.

Energy app supports up to 6 Modbus-based RS-485 power meters that connect to ComView RS-485 port. The RS-485 app reads Modbus registers from these power meters, maps hexadecimal values to decimal numbers, converts them to power and energy measurements in kW, kVA, kVAR, kWh, kVAh, and kVARh (availability of these variables is power meter-dependent), and normalizes these measurements in CSV-formatted data records with timestamps.

Energy app uses CSV-formatted data records from RS-485 app to:

- Calculate 'Hourly', 'Daily', and 'Monthly' energy consumption data (in kWh, kVAh, kVARh) and log these in data files, one per meter
- Monitor 'Hourly' and 'Daily' energy consumption data (in kWh, kVAh, kVARh) for alarm conditions
- Monitor power data (in kW, kVA, kVAR) for alarm conditions

Energy app generates CSV-formatted records for its calculated values and stores them in raw data files, one per meter. These files can be automatically pushed to a remote server for storage and for further user-specific data processing.

This application note is intended to provide an overview of Energy app and how to configure it for measuring and monitoring power and energy consumption.

This application note does not provide detailed description of how to use ComView, its connectivity and configuration, and other supporting information, as these are beyond the scope of this document. Refer to other resources for more details.

References:

- [1]. ComView - User Guide

Power Meter Setup

Meter Setup section allows users to select a meter from the 'Select Meter No.' dropdown list. Operation of the selected meter [0..5] can be defined in the entries thereafter as shown below:

Meter Enable:

Description: To enable or disable Energy application for meter [0..5]

Usage: Select [Yes,No]

Meter Name:

Description: To define name for meter [0..5] for identification purposes

Usage: Enter a string up to 24 characters

Data Field Mapping:

Description: To define mapping of data fields in RS-485 data record to power and energy data fields for meter [0..5]. From left to right, the data fields represent 'kW', 'kVA', 'kVAR', 'kWh', 'kVAh', 'kVARh'.

Usage: Select VarX (X=[0..9]) from dropdown lists for variable that corresponds to data field in RS-485 record.

Note: RS-485 record from RS-485 app defines what measurement type each variable (VarX) represents - kW, kVA, kVAR, kWh, kVAh, or kVARh

Power Alarm Thresholds:

Description: To define alarm conditions on power measurement for meter [0..5]

Usage: Select measurement from dropdown list and enter values in 'Low', 'High', 'Tolerance' input fields:

- Measurement: [None, kW, kVA, kVAR]:
 - o None: no power alarm detection
 - o kW: alarm detection on RS-485 data field (Var_) assigned to 'kW'
 - o kVA: alarm detection on RS-485 data field (Var_) assigned to 'kVA'
 - o kVAR: alarm detection on RS-485 data field (Var_) assigned to 'kVAR'
- Low: Low power alarm threshold, decimal number in unit of selected power
- High: High power alarm threshold, decimal number in unit of selected power
- Tolerance: Tolerance, decimal number in unit of selected power

Hourly Energy Alarm Thresholds:

Description: To define alarm conditions on 'Hourly' energy measurement for meter [0..5]

Usage: Select measurement from dropdown list and enter values in 'Low', 'High', 'Tolerance' input fields:

- Measurement: [None, kWh, kVAh, kVARh]:
 - o None: no energy alarm detection
 - o kWh: alarm detection on RS-485 data field (Var_) assigned to 'kWh'
 - o kVAh: alarm detection on RS-485 data field (Var_) assigned to 'kVAh'
 - o kVARh: alarm detection on RS-485 data field (Var_) assigned to 'kVARh'
- Low: Low energy alarm threshold, decimal number in unit of selected energy
- High: High energy alarm threshold, decimal number in unit of selected energy
- Tolerance: Tolerance, decimal number in unit of selected energy

Daily Energy Alarm Thresholds:

Description: To define alarm conditions on 'Daily' energy measurement for meter [0..5]

Usage: Select measurement from dropdown list and enter values in 'Low', 'High', 'Tolerance' input fields:

- Measurement: [None, kWh, kVAh, kVARh]:
 - o None: no energy alarm detection
 - o kWh: alarm detection on RS-485 data field (Var_) assigned to 'kWh'
 - o kVAh: alarm detection on RS-485 data field (Var_) assigned to 'kVAh'
 - o kVARh: alarm detection on RS-485 data field (Var_) assigned to 'kVARh'
- Low: Low energy alarm threshold, decimal number in unit of selected energy
- High: High energy alarm threshold, decimal number in unit of selected energy
- Tolerance: Tolerance, decimal number in unit of selected energy

RS-485 Interface:

Description: To define physical interface for meter [0..5]

Usage: Select values from 'Port' and 'Device' dropdown lists for port number and device number

Set Output on Alarm:

Description: To define output control on alarm detection for meter [0..5]

Usage: Select values from dropdown lists for output number, output state, and its activated time duration

Raw Data File Size:

Description: To define raw data file size in kilo bytes (kB), the percentage (%) to remove data in FIFO manner when file overflows its limit, and the time interval in minutes (min) to check the file size.

Usage: Enter values in 'kB,%,min' format

Data Source Filename:

Description: To define pathname of source data file for meter [0..5] for Energy application to process. If file pathname is present, the application will not process real-time data but use this

data file instead. This function is intended for testing purposes only or to process historical data.

Usage: Enter a valid full pathname to source data file in the device. This input field should be empty in normal operation.

Note: If file pathname is present, the application will not process real-time data but use this data file instead. This function is intended for testing purposes only or to process historical data.

From the above, users can define and monitor alarm conditions on power measurement (kW, kVA, or kVAR), hourly energy consumption (kWh, kVAh, or kVARh), and daily energy consumption (kWh, kVAh, or kVARh) with Low and High thresholds and automatic activation of output on alarm.

Energy Consumption Data

Energy app helps users simplify energy consumption management by performing frontend processing that deals with Modbus-based data acquisition from power meters, data conversion of Modbus register values, intensive power and energy calculations and tabulations, and normalizing pre-processed data into CSV-formatted records with timestamps to ease further data processing.

For user convenience, energy consumption data files can be scheduled to upload automatically to a remote server for storage and for further user-specific data processing.

Energy app CSV-formatted record has the following format:

YYYYMMDD, HHMMSS, MeterNo, P, UoM0, S, UoM1, Q, UoM2, EP, UoM3, ES, UoM4, EQ, UoM5

YYYYMMDD:	Date stamp
HHMMSS:	Time stamp
MeterNo:	Meter number [0..5]
P:	Value of real power
UoM0:	Unit of measurement of P, in kW
S:	Value of apparent power
UoM1:	Unit of measurement of S, in kVA
Q:	Value of reactive power
UoM2:	Unit of measurement of Q, in kVAR
EP:	Value of real energy
UoM3:	Unit of measurement of EP, in kWh
ES:	Value of apparent energy
UoM4:	Unit of measurement of ES, in kVAh
EQ:	Value of reactive energy
UoM5:	Unit of measurement of EQ, in kVARh

Example:

20220309,144713, 0, 1.44, kW, 1.8, kVA, 1.08, kVAR, 12, kWh, 13, kVAh, 14, kVARh

With pre-processed energy consumption data in CSV-formatted records, data files can be readily processed further according to user-specific requirements for trend analysis and reporting using common software such as Microsoft Excel and Google Sheets.

Power and Energy Monitoring

Energy app helps users monitor power and energy variables according to user-defined alarm conditions. Users can define low and high thresholds along with tolerance to meet their monitoring requirements.

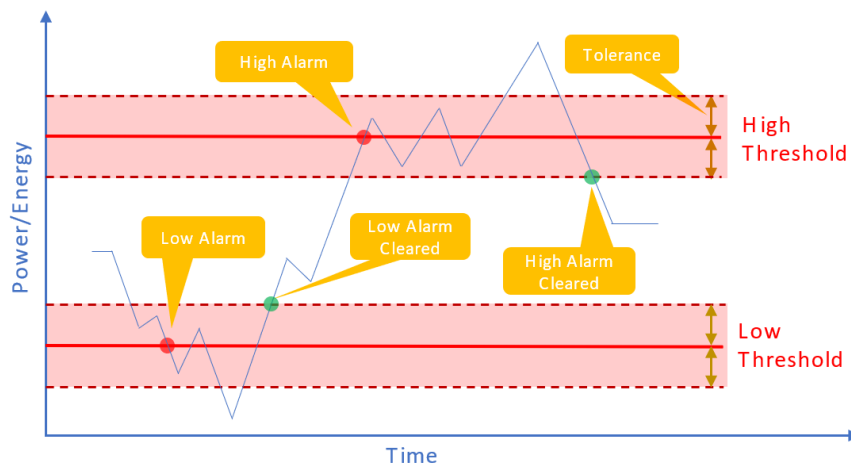
On detecting an alarm condition, Energy app generates an alarm record, logs it in an alarm file, automatically notifies users of the condition, and optionally take corrective action by activating outputs (i.e., controlling onsite audible/visual devices).

Energy app monitors alarm conditions based on user-defined value for input field labeled as 'Power Alarm Thresholds', 'Hourly Energy Alarm Thresholds', and 'Daily Energy Alarm Thresholds' on its web page, such as:

Power Alarm Thresholds	kW	2	8	0.2
Hourly Energy Alarm Thresholds	kWh	2	14	0.8
Daily Energy Alarm Thresholds	kWh	60	420	25

The app detects an alarm condition based on user-selected measurement that 'falls below' the Low threshold and that 'rises above' the High threshold.

Tolerance value is used to prevent repetitive alarm conditions of the same type from generating new alarms and alarm notifications, i.e., alarms of the same type must be cleared first prior to the new one being generated, as shown below:



From the above,

Low threshold alarm:

Selected measurement \leq Low

Low threshold alarm cleared:

Selected measurement > (Low + Tolerance)

High threshold alarm:

Selected measurement \geq High

High threshold alarm cleared:

Selected measurement < (High – Tolerance)

Using the above threshold settings for power (2,8,0.2), hourly energy (2,14,0.8), and daily energy (60,420,25), Energy app will detect power and energy alarms with values as captured in the alarm records below.

```
20220801,060000,RS-485,Meter 5,1.606,kW,Power low
20220801,060000,RS-485,Meter 5,1.599,kWh,Hourly energy low
20220801,120000,RS-485,Meter 5,6.145,kW,Power low alarm cleared
20220801,120000,RS-485,Meter 5,10.402,kWh,Hourly energy low alarm cleared
20220801,181500,RS-485,Meter 5,9.147,kW,Power high
20220801,180000,RS-485,Meter 5,15.12,kWh,Hourly energy high
20220802,000000,RS-485,Meter 5,2.453,kW,Power high alarm cleared
20220802,000000,RS-485,Meter 5,6.854,kWh,Hourly energy high alarm cleared
20220802,060000,RS-485,Meter 5,1.299,kW,Power low
20220802,060000,RS-485,Meter 5,1.421,kWh,Hourly energy low
20220802,120000,RS-485,Meter 5,5.794,kW,Power low alarm cleared
20220802,120000,RS-485,Meter 5,5.612,kWh,Hourly energy low alarm cleared
20220802,180000,RS-485,Meter 5,8.025,kW,Power high
20220802,180000,RS-485,Meter 5,17.479,kWh,Hourly energy high
20220803,000000,RS-485,Meter 5,4.69,kW,Power high alarm cleared
20220803,000000,RS-485,Meter 5,7.889,kWh,Hourly energy high alarm cleared
20220803,060000,RS-485,Meter 5,1.552,kW,Power low
20220803,060000,RS-485,Meter 5,1.767,kWh,Hourly energy low
20220803,120000,RS-485,Meter 5,3.079,kW,Power low alarm cleared
20220803,120000,RS-485,Meter 5,6.313,kWh,Hourly energy low alarm cleared
20220803,180000,RS-485,Meter 5,9.836,kW,Power high
20220803,180000,RS-485,Meter 5,16.446,kWh,Hourly energy high
20220804,000000,RS-485,Meter 5,3.896,kW,Power high alarm cleared
20220804,000000,RS-485,Meter 5,9.819,kWh,Hourly energy high alarm cleared
20220805,000000,RS-485,Meter 5,0.475,kWh,Hourly energy low
20220805,000000,RS-485,Meter 5,32.598,kWh,Daily energy low
20220806,000000,RS-485,Meter 5,17.854,kWh,Hourly energy low alarm cleared
20220806,000000,RS-485,Meter 5,17.854,kWh,Hourly energy high
20220806,000000,RS-485,Meter 5,398.46,kWh,Daily energy low alarm cleared
20220807,000000,RS-485,Meter 5,7.673,kWh,Hourly energy high alarm cleared
```


On alarm detection, ComView will also notify users of alarm using the alarm delivery methods that users define.

Energy Reports

Energy Reports section allows users to select a meter to view its power and energy data summary. This includes total number of data points, first and last data point timestamps, and the last 5 data records for references.

Users can select a report from the dropdown list of Power, Energy - Hourly, Energy - Daily, Energy - Monthly. To plot, enter the chart title and define chart data range – All data points, First Data Points, and Last Data Points. When Last Data Points is selected, users can click on 'Refresh' button to view chart updates in real-time for 1 minute duration. Re-click the button to continue viewing. Users can also zoom in the chart to view finer details of data series.

Energy reports are shown below with sample data:

 **ENERGY REPORTS**

Available Meters:

=== Power & Energy ===

Total data points = 11809

First data point timestamp= 20220801, 000000

Last data point timestamp= 20221202, 000000

Last 5 data points:

20221202,000000,5,4.788,kW,2.466,kVA,3.591,kVAR,23907.534,kWh

Select Meter No.: 0 1 2 3 4 5

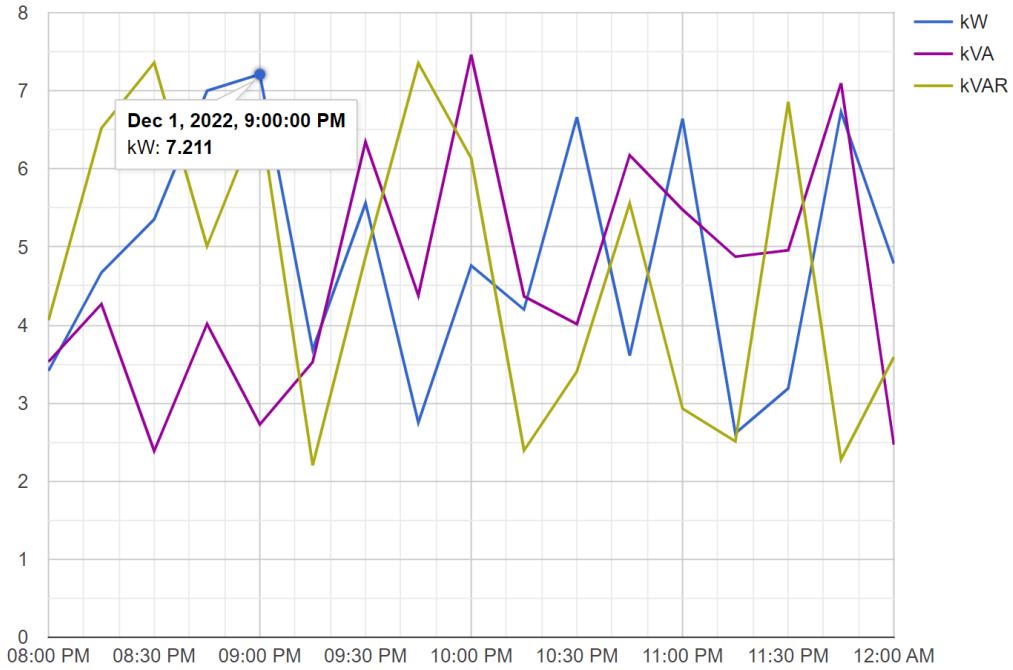
Select Report Type:

Chart Data Range:

All / Or

Chart Title:

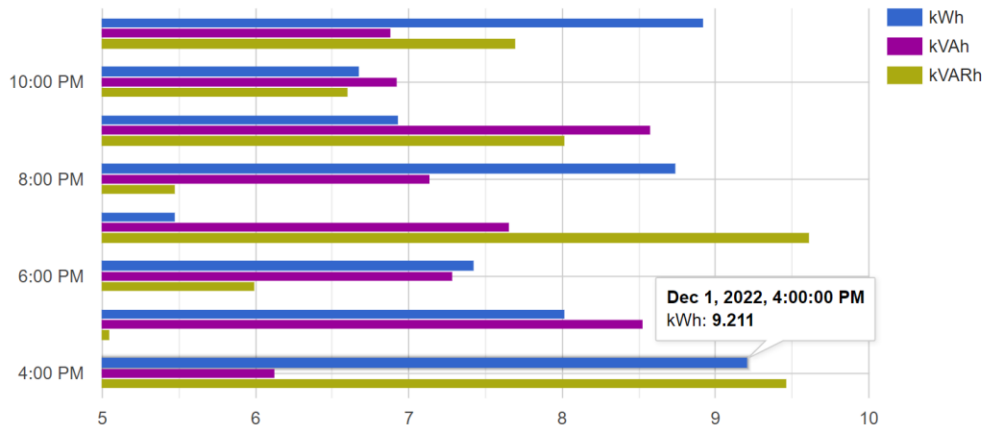
Power Chart (Last 4 hrs)



Refresh

Apply

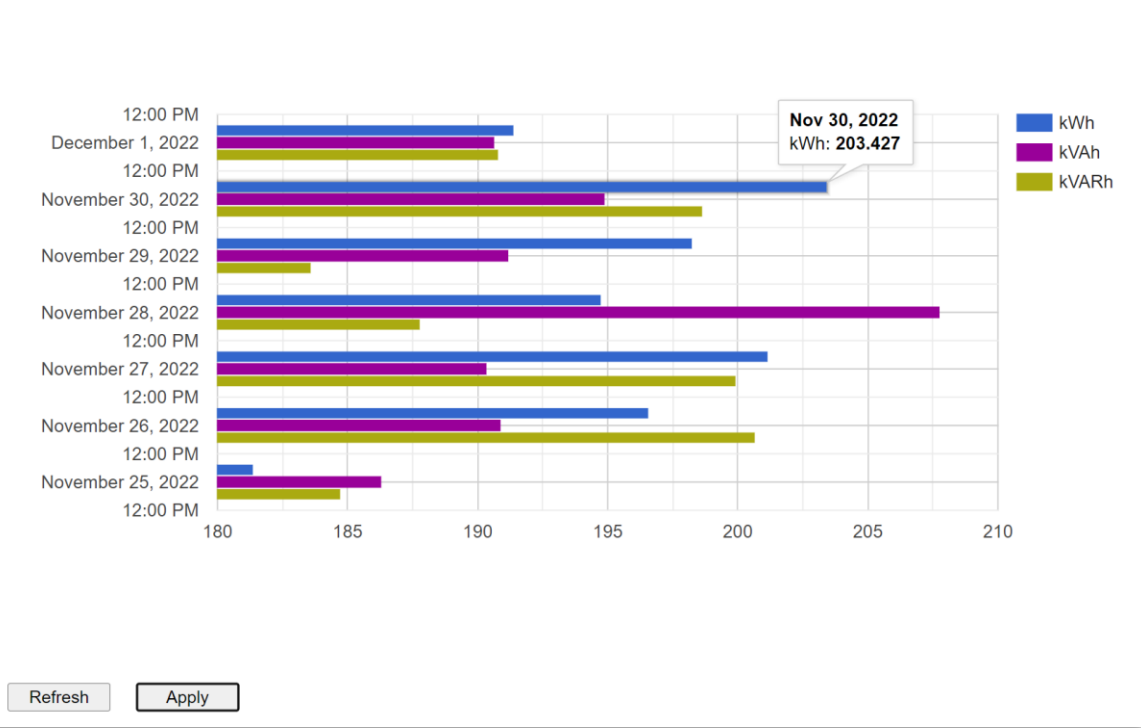
Hourly Energy Consumption (Last 8 hrs)



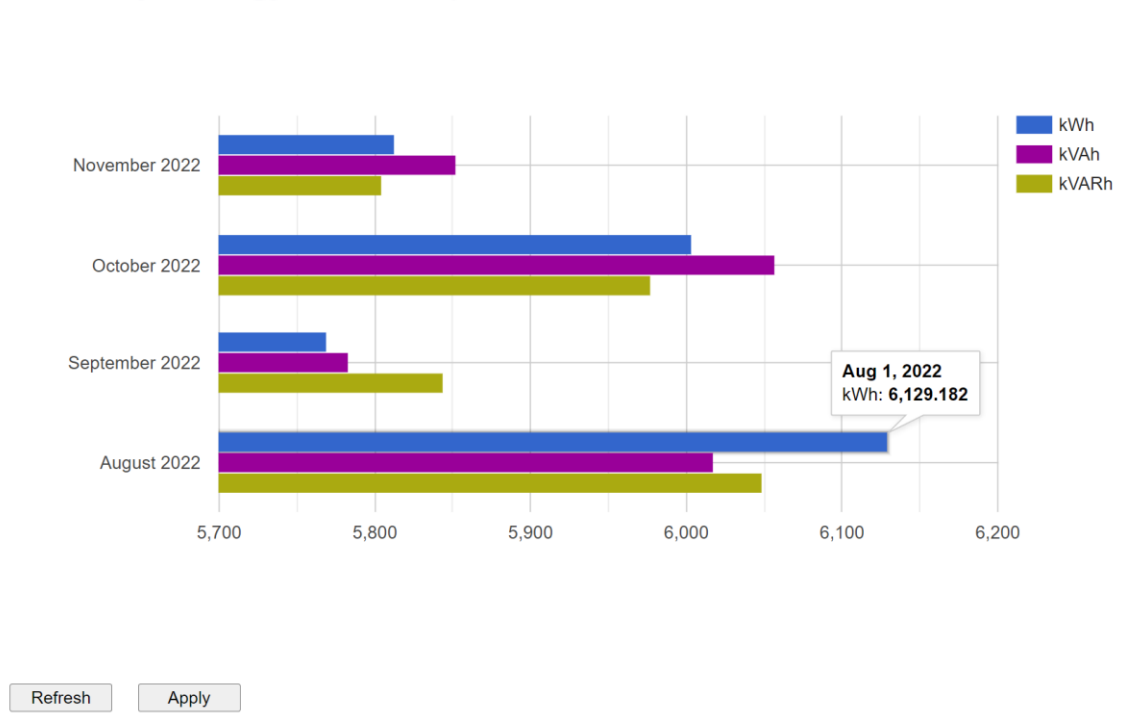
Refresh

Apply

Daily Energy Consumption (Last 7 days)



Monthly Energy Consumption (Last 4 months)



With data visualization, users can quickly identify areas of interests such as unusual energy consumption spikes or get better views of energy consumption trends.

Summary

This application note illustrates how ComView Energy app helps users simplify the tasks of power and energy consumption monitoring by performing the complex frontend calculations and data processing. The results let users measure and monitor power and energy variables according to their defined Low and High alarm thresholds. The application note also shows the additional benefits that users can realize from Energy app with its CSV-formatted data records for further upstream data processing and instant real-time data visualizations of hourly, daily, and monthly energy consumption.

About CSSTEL

CSSTEL is a privately held developer and manufacturer of ComView hardware and software solutions for secure, remote infrastructure site management since 1997 with installations in over 30 countries around the world.

We offer ComView solutions that are scalable and customizable to monitor and manage virtually the entire spectrum of remote site infrastructure and site conditions.

We help telecom service providers, carriers, financial institutions, healthcare providers, government agencies, utilities, and other public and private sector organizations maintain constant visibility and control over their remote site infrastructure.



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Revision History

Revision	Date	Description
1.00	2023-01-08	Initial release

*** End of document ***