SECTION 260913 ELECTRICAL POWER MONITORING

PART 1.0 - GENERAL

1.1 DOCUMENTS

1. Please note: that this section of the Specifications forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts listed by the appropriate parties below.

1.2 SYSTEM DESCRIPTION

1. The products specified herein are intended to provide a complete sub-metering solution. This solution shall be utilized to measure and monitor owner provided electricity and other utility commodities through 3rd party meters and sensors that meet system connection specifications. System will also allow for compliance with national and local energy codes and provide equipment needed to meet specific LEED M&V credits.

1.3 SECTION INCLUDES

1. Electrical sub-metering equipment, data collection systems, and data management software systems including:
    a. Standard single point kWh electrical sub-meters
    b. Advanced single point kWh electrical sub-meters
    c. Multi-point electrical sub-meters
    d. Data Logging Gateways
    e. High Density I/O Modules
    f. Open protocol data communication network
    g. Wireless communication modules
    h. Cloud Energy monitoring and tenant billing software

1.4 STANDARDS

1. Provide equipment of this Section in full compliance with the following applicable portions of the latest revisions of the following standards:
    a. ANSI C12.1 & C12.20 at 0.2 and 0.5 Accuracy Classes
    b. UL Certified to IEC/EN/UL/CSA 61010-1 2nd Edition.
    c. UL916:
        i. These requirements cover energy management equipment and associated sensing devices rated 600 volts or less and intended for installation in accordance with the National Electrical Code, NFPA 70.
    d. NEMA -SM31000-1

1.5 SHOP DRAWINGS

1. Installation and Shop Drawings to include the following:
    a. Manufacturer’s literature and specification
    b. Component connection wiring diagrams
    c. Communications system specification

1.6 INSTALLATION, OPERATION, AND MAINTENANCE MANUALS

1. Submit installation, operation, and maintenance manuals for the electrical sub-metering system data collection system, and data management software.

1.7 TECHNICAL PERFORMANCE

1. Minimum measured technical performance of each piece of installed equipment shall meet the specifications published by the manufacturer.

2. Optimize technical performance of all systems to produce the highest achievable technical performance to the satisfaction of consultant and/or client.

3. Any deficiencies in the system, particularly information communication errors or operational deficiencies, shall be cause for rejection. Rectify any such deficiencies prior to calling for substantial completion review.

1.8 WARRANTY

1. Manufacturer shall provide a comprehensive warranty for all products.

2. All electrical sub-meters included in this specification to be free from defects in materials and workmanship from the date of substantial completion for a period of 5 Years.

3. All data collection system components included in this specification to be free from defects in materials and workmanship from the date of substantial completion for a period of 5 Years.

PART 2.0 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

1. Acceptable Manufacturer: Leviton Manufacturing Co. Inc.

2. Basis of Design: Leviton VerifEye Metering System.

3. Substitutions [Permitted] [Not Permitted]:

    a. Show all substitutions as an add or deduct from base bid pricing.

    b. Provide Manufacturer’s reference list.

    c. Clearly delineate all propose substitutions as such and submit in writing for approval by the engineer a minimum of 10 working days prior to the bid date

    d. Prior to rough-in, provide complete engineered shop drawings, including power wiring, with deviations for the original design highlighted in an alternate color, to the engineer for review and approval.

    e. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

2.2 METERS AND CURRENT TRANSFORMERS

1. Standard single point metering devices: Leviton Mini-Meters, Series 1000, and Series 2000

2. Advanced single point metering devices: Leviton Series 4000 & 4100, Series 6000 and Series 7000

3. Multipoint metering devices: Leviton Series 7000, 7100 or 8000

4. Leviton solid or split core current transformers with full scale output of 0.1A or 0.333v

5. Leviton Rogowski coil current transformers.

6. Solid Core current transformers available for 100-400A and split core current transformers available from 50A - 5,000A.

7. Current transformer secondary conductor wire extension limits:

    a. 500’ for 0.1A CT’s
    b. 300’ for 0.333V CT’s
    c. 20’ - 100’ for Rogowski Coil CT’s

2.3 SYSTEM DESCRIPTION – SINGLE POINT METERING DEVICES

1. Provide single point metering devices capable of metering 1PH/2W, 2PH/3W, 3PH/3W, and/or 3PH/4W loads.

2. Meters must be capable of directly metering North American 120/208/240v,277/480V and 347/600V.

3. Metering units must be capable of metering loads between 50A and 5000A. Provide meters specific to each project as indicated on construction drawings.

4. Meters may have multiple mounting options:

    a. Indoor-Flush Mount, Surface Mount, Panel Mount -JIC Steel, Polycarbonate, Multiple Meter Unit
    b. Outdoor-Surface Mount, Polycarbonate NEMA 4X

5. Metering Units may have the capability of paralleling up to 3 (three) sets of CTs per phase. Not applicable to Rogowski coil applications.

6. Must meet all ISO 9001 standards for quality control where all meters test to a minimum of +/- 0.2% or 0.5% accuracy, dependent on stated accuracy class.

7. The system shall be as described below:

    a. To consist of electronic meters with embedded communications capability, and solid core, split-core or Rogowski coil current transformer technology. The current transformers shall have a full scale output of 0.1A or .333v and secondary voltage clamps for safety purposes.

    b. The meters will be capable of remote communication from each metering device.

    c. Standard meters shall have isolated pulse output with output ranges from 10Wh to 1kWh.

    d. Advanced meters shall transmit data via one or more of the following communication protocols:

i. Isolated Pulse Output
ii. Modbus TCP/IP
iii. BACNet IP
iv. Modbus RTU
v. BACNet MS/TP

e. Backup power provided by on-board battery maintains the real time clock through power loss (Advanced Meters Only). Energy data is stored in non-volatile memory to maintain value through power loss. Device is capable of holding 60 days of historical energy usage data in default settings (Advanced Meters Only).

f. Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system.

8. The electronic energy monitoring system shall be fully automated microprocessor-based electrical energy measurement system for Measurement & Verification and Tenant Billing purposes. The system shall incorporate complete metering, communications, reporting functions; energy monitoring and threshold limit capabilities.

2.4 SYSTEM MEASUREMENTS – SINGLE POINT METERING DEVICES

1. Meters to be complete with a Liquid Crystal Display (LCD) to access all energy measurements and phase diagnostics when needed

2. Standard Meter Energy Parameters:

a. kWh real energy consumption
b. kW peak peak demand (power)

3. Advanced Meter Energy Parameters:

a. Bi-directional Energy Measurements
b. kWh real energy consumption
c. kW peak peak demand (power)
d. kW instantaneous demand (power)
e. kVAh apparent energy consumption
f. kVA total apparent power
g. kVARh reactive consumption
h. kVAR total reactive power
i. PF power Factor Total
j. Maximum kW peak demand with time and date stamp
k. Line Frequency Hz

4. Advanced Meter Phase Diagnostics: Parameters to be displayed for each individual phase of each metered load:

a. Voltage Phase to neutral or phase to phase
b. Amps Instantaneous amperage for each phase
c. kW Instantaneous real energy
d. PF Power factor
e. kVA Instantaneous apparent energy
f. KVAR Instantaneous reactive energy
g. THD Total Harmonic Distortion

2.5 SYSTEM DESCRIPTION – MULITPOINT METERING DEVICES

1. The system shall be as described below:

    a. To consist of electronic multiple point meters with embedded communications capability, and solid core, split-core or Rogowski coil current transformer technology. The current transformers shall have a full-scale output of 0.1A or .333v A/C outputs and secondary voltage clamps for safety purposes.

    b. Meters to be used for Energy Monitoring and Tenant Billing applications

    c. Meters shall be capable of mounting in the following configurations:

        i. Indoor-NEMA 1 Enclosure, Metallic backplate
        ii. Outdoor-NEMA 4X

    d. The meters will be capable of remote communication from each metering device. Each device shall have IP sockets and RS-485 terminals to accommodate data transmission via Modbus RTU, Modbus TCP/IP, BACNet MS/TP, BACNet IP and standard Ethernet. Data shall be transmitted by one or a combination of the following:

        i. Standard Ethernet interface
        ii. Ethernet connection to PC or laptop via crossover cable.
        iii. RS-485 Network-Modbus RTU & BACNet MS/TP

    e. Systems to have backup storage power to key components so no data is lost during power outages. The system shall continue to function after resumption of power.

    f. Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system.

2. The electronic energy monitoring system shall be fully automated microprocessor-based electrical energy measurement system for Measurement and Verification and Tenant Billing purposes. The system shall incorporate the following:
    a. Complete metering
    b. Communications
    c. Reporting functions
    d. Energy monitoring
    e. Threshold limits capabilities.

3. Meters must be capable of directly metering on board, North American 120/208/240V, 277/480V and 347/600V.

4. Meters may require Potential Transformers in 480v Delta and 347/600v applications.

5. Meters may be capable of two distinct and independent reference voltage inputs to allow for monitoring two separate electrical systems. Meter must allow any CT input to be referenced against either input voltage channel.

6. Metering Units may have the capability of a Wiring Harness, single incoming cable containing 25 pairs of 22 AWG wire with associated current transformers (CT's) or optional Terminal Strips, screw terminal connections for CTs. Metering Units may also be configured with individual input channels for CT's secondary wires.

7. Must meet all ISO 9001 standards for quality control where all meters test to a minimum of +/- 0.2% or 0.5% accuracy, dependent on accuracy class.

8. Metering unit (S-8000)must be configurable to meter 24 single-pole circuits, 12 two-pole circuits, or 8 three-pole circuits

9. Metering unit (S7000) must be configurable to meter 48 single pole circuits, 16 two pole circuits or 16 three-pole circuits.

10. Metering Unit (7300) must be configurable for up to 24 virtual meters-meters to be any combination of 1, 2 or 3 poles circuits.

11. Metering unit (S7000) must be configurable to meter 24 single pole circuits, 8 two pole circuits or 8 three pole circuits.

12. Metering unit (S7000) must be configurable to meter 12 single pole circuits, 4 two-pole circuits or 4 three-pole circuits.

2.6 SYSTEM MEASUREMENTS – MULITPOINT METERING DEVICES

1. Meters to be complete with a Liquid Crystal Display (LCD) to access energy measurements and phase diagnostics when needed.

2. Energy Parameters:

a.	kWh	real energy consumption
b.	kW	instantaneous power
c.	kVAh	apparent consumption
d.	kVA	apparent power
e.	kVARh	reactive consumption
f.	kVAR	reactive power
g.	Line Frequency	Hz

3. Phase Diagnostics: Parameters to be displayed for each individual phase of each metered load:

a.	Voltage	Phase to neutral or phase to phase
b.	Amps	Instantaneous amperage for each phase
c.	kW	Instantaneous power
d.	PF	Power factor
e.	PA	Phase angle
f.	kVA	Instantaneous apparent energy
g.	KVAR	Instantaneous reactive energy
h.	THD	Total Harmonic Distortion-Theta

2.7 METER DATA COLLECTION AND COMMUNICATION

1. Data acquisition sever: Leviton Energy Monitoring HUB
2. Pulse data collection: Leviton High Density Pulse Module
3. Wireless data transmission: Leviton ModHopper

2.8 SYSTEM DESCRIPTION - METER COMMUNICATIONS AND DATA COLLECTION

1. The system shall be as described below:

a. To consist of energy management hubs, pulse modules, wireless communication devices, and software used to transmit, collect, and display data provided by sub-metering equipment used to capture measurements from utilities that include, but are not limited to, electrical, gas, water, and steam.

b. System to allow all data collected to be connected to IP based applications including Third Party Billing Companies/Software, Enterprise Energy Management Software, Demand Response, and Smart Grid Collection for use in power measurement and tenant billing.

c. Data collection system shall be all non-proprietary and compatible with industry standard M&V software applications. Open industry standard protocols such as Modbus, BACNet pulse outputs, analog, resistive inputs, etc. shall be utilized. No proprietary or manufacturer specific protocols between meter and data collectors shall be accepted.

2.9 PRODUCT REQUIREMENTS - DATA AQUISITION SERVER

1. Provide data acquisition servers that capture and log data from electrical meters, and other compatible meters and environmental sensors.

2. DAS Product Listing-
   a. EMHXD-220-Gen 4 HUB
   b. EMHSP-214-Gen 4 HUB
   c. A8810-000 EMB HUB
   d. A7810-000 HUB Lite

3. Server shall comply with the following codes and standards:
   a. FCC CFR 47 Part 15, Class A
   b. EN 610000
   c. EN 61326
   d. CE
   e. UL 61010

4. Server shall be equipped with an Linux 4.x OS, iMX 6 UltraLite processor, 512MB of onboard RAM, 4.0 GB of NOR flash memory, and a USB expansion port.

5. Server shall operate under the following conditions:
   a. 22°F to 158°F (-30C to 70°C), 0-90% RH, non-condensing

6. Server shall have the capability to collect and log information at intervals from one (1) to sixty (60) minutes.

7. Server shall timestamp all acquired data and store it in a non-volatile memory.

8. Server shall use modem and/or Ethernet connections for internet access allowing either static IP (internet protocol) or DHCP (Dynamic Host Control Protocol) addressing.

9. Server shall communicate with metering data points via wired or wireless connections over the following protocols:
   a. Wired communications:
      i. Pulse

ii. Ethernet-Modbus TCP/IP
iii. BACNet I/P
iv. RS-485-Modbus RTU
v. RS-485-BACNet MS/TP
a. Modbus/BACNet devices to be connected via Belden 1120A or equivalent 18g twisted shielded pair.

b. Wireless Communications:
i. Wireless Modbus

10. Server shall communicate with external devices via hard-wired or wireless connections over the following protocols:
a. Wired communications:
i. Ethernet LAN (Local Area Network) or WAN (Wide Area Network)
ii. TCP/IP
iii. PPP
iv. HTTPS/HTML
v. FTP
vi. NTP
vii. XML
viii. SNMP-Trap
ix. BACnet-Optional Downloaded Module
b. Wireless Communications:
i. GSM (Global System for Mobile Communications)
ii. GPRS (General Packet Radio Service)
iii. PSTN (Public Switched Telephone Network)

c. Server shall upload data at user selectable scheduled intervals via HTTPS or FTP and download data in XML or custom formats.

d. Server shall operate four distinct and independent upload channels.

11. Server shall generate alarms for data points including SNMP (Simple Network Management Protocol) traps.

12. Server shall have the following input and output connections:
a. Input:
i. One or Two (2) Ethernet Ports-RJ45,10/100 Ethernet, full half duplex, auto polarity
ii. One or Two RS485 Modbus serial ports capable of supporting 32 external devices. Input capacity to be expandable at owner's option.
iii. May have up to four (4) Flex analog inputs
b. Output:
i. May have two (2) dry contact relays rated at 30VDC and 150mA maximum

2.10 PRODUCT REQUIREMENTS – HIGH DENSITY PULSE MODULES

1. Provide high density pulse module for collection and distribution of pulse output data generated by electric, gas, water, steam, BTU meters, and environmental sensors (humidity, temperature, etc.).

2. Module shall have on-board, adjustable Modbus addressing via dip switches with addresses from 1-128.

3. Module shall comply with the following codes and standards:
    a. FCC CFR 47 Part 15, Class A emissions standard.

4. Module shall be equipped with an ARM7 I/O processor with field-upgradable firmware.

5. Module shall communicate over a Modbus / RTU RS-485, two wire network with the following network speeds
    a. 19200 Baud
    b. 9600 Baud

6. Module shall operate under the following conditions
    a. -22°F to 158°F (-30°C to 70°C), 0-90% RH, non-condensing

7. Module shall have a 32-bit pulse counter which rolls over at 4.295 billion pulses per channel and store pulse data in a non-volatile memory. Pulse rate shall be user selectable.

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8. Module shall have the following input and output connections
    a. Input
        i. Non isolated pulse and power inputs
        ii. Modbus RS485 connection
        iii. Twenty-three (23) independent pulse count inputs designed for use with dry contact outputs. The pulse rate shall be user selectable between the following:
            a. 10Hz: Minimum pulse width to be 50ms
            b. 50Hz: Minimum pulse width to be 10ms
            c. 100Hz: Minimum pulse width to be 5ms

2.11 PRODUCT REQUIREMENTS – WIRELESS TRANSCEIVER

1. Provide OPTIONAL wireless transceiver for collection and distribution of pulse outputs generated by electrical meters, other energy and water meters and environmental sensors.

2. Transceiver shall comply with the following codes and standards:
    a. FCC CFR 47 Part 15, Class A emissions standard.
    b. FCC ID to be OUR-9XTREAM
    c. Industry Canada ID to be 4214A-9XTREAM

3. Transceiver shall be equipped with a 60 MHz ARM7 embedded CPU.

4. Transceiver firmware to be field upgradable.

5. Transceiver shall communicate over a self-healing, self-optimizing wireless mesh network. Network shall utilize frequency hopping, spread-spectrum radio transmission and reception over 900MHz band.

6. Transceiver shall have a range of 3000 feet indoors and 14 miles outdoor line of sight.

7. Transceiver broadcast power shall be 1 watt.

8. Transceiver shall operate under the following conditions
    a. 32°F to 122°F (0°C to 50°C), 0-90% RH, non-condensing
    b. 1.24 miles (2000m) maximum altitude, degree 2 pollution

9. Transceiver shall have a pulse counter with pulse data stored in a non-volatile memory.

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10. Transceiver shall have the following input and output connections. Modbus addresses to be adjustable via DIP switches with addresses between 1 and 247.
    a. Input
        i. Two (2) Pulse inputs with user selectable pulse rates of 10, 50, 100, or 250 Hz.
        ii. Modbus RS485 input
        iii. Connect a maximum of 32 Modbus devices to transceiver input
    b. Outputs to be user selectable between 100 Ohms and 2.5 kOhms.
        i. Two (2) opto-FET dry contact relays rated at 30VDC, 150mA max.

2.12 PRODUCT REQUIREMENTS-RESIDENTAIL MDU RF (Wireless) Automatic Meter Reading System

1. System Shall be composed of Meter Data Transmitters, System Repeaters and Data Concentrator Access Points (DCAP)
2. System shall operate within the 902-928 MHz frequency band. System shall operate as a spread spectrum, frequency agile system.
3. System shall be FCC Part 15 approved for unlicensed use in U.S. applications.
4. System shall deliver user defined reports in human readable formats such as excel, .csv.
5. System shall have the capability to deliver 15 minute interval data (optional)
6. System will offer battery powered Meter Data Transmitters with a 5-year battery life.
7. System Components
    a. MDT-Meter Data Transmitter
        i. MDT shall have the ability interface with the following technologies:
            a. Dry contact closure (pulse output)
            b. Encoded Technologies (Neptune, Sensus)
            c. Modbus RTU
        ii. MDT shall transmit over the 902-928 MHz frequency band
        iii. MDT shall operate as frequency hopping device within a defined spread spectrum.
        iv. MDT Shall have an open field range of at least 2500’
        v. MDT shall transmit an alert when cover is removed
        vi. MDT shall operate from -20 to 140 degrees F up to 90% RH, non-condensing
        vii. MDT product shall offer dual pulse input options
        viii. MDT shall derive power from:
            a. On board, changeable AA batteries; 5 year typical battery life.
    b. Network Diversity Repeater
        i. Repeater shall operate over the 902-928 MHz frequency band.
        ii. Repeater shall create a redundant, self-healing 2-way mesh network between MDT’s and DCAP.
        iii. Repeater shall deliver +28.5dBm transmission power
        iv. Repeater shall have an open field range of 2 miles.
        v. Repeater shall operate from -10 to 140 degrees F up to 90% RH, non-condensing.
        vi. Repeater shall be powered by a wall transformer delivering 5V DC, 800mA,

vii. Repeater shall send an alert message if power is interrupted.

c. Data Concentration Access Point-DCAP

i. DCAP shall operate as the Head End of the AMR system

ii. DCAP shall manage a central database for all system information:

a. Site specific information
b. MDT Radio ID's
c. Repeater Radio ID's
d. Meter Serial Numbers
e. Meter to APT cross reference information
f. System Notes
g. Maintenance Information

iii. DCAP shall collect and store all meter readings from system MDT's.

iv. DCAP shall have the capacity to manage and store data for 2000 individual meter points

v. DCAP shall communicate with cloud via 10/100 Ethernet or cellular modem (optional)

vi. DCAP shall offer data output formats as follows:

a. Email with .CSV or .OUT file format
b. FTP and Secure FTP
c. CIT Software

vii. DCAP shall be configured using PC based application-CIT (Configuration and Installation) tool. CIT tool will have the following features:

a. Readable labeling of all MDT Radio ID's
b. All Site Information to include the site access code.
c. Mass upload capability of site configuration information via excel
d. Configurable network parameters for reporting
e. Network Typology for wireless system troubleshooting
f. Check-In Monitor to map progress of system installation

viii. DCAP shall operate from -10 to 145 degrees F, up to 90 RH, non-condensing

ix. DCAP shall be powered using wall transformer (5V DC, 1Amp)

x. DCAP shall allow for programming Initial Meter Reading to match meter odometer and electronic reading.

2.13 CLOUD BASED ENERGY INFORMATION SOFTWARE

1. Software package shall consist of one or more of the following WEB based system modules:
   a. Basic Building Management Software: BMO Base Module
   b. Enterprise Energy Management Software: BMO Advanced Reporting Module
   c. Tenant Billing Software: BMO Tenant Billing Module

2.14 PRODUCT REQUIREMENTS-BASIC SOFTWARE-BMO BASE MODULE

1. BMO Base Module is a basic energy information platform that allows for basic reporting of limited graphing of energy information collected from energy and water meters and environmental sensors.

2. Provide a web hosted software platform which is fully functional without software other than standard web browsers including, but not limited to, Microsoft Internet Explorer, Google Chrome and Firefox Mozilla

   a. Software shall support multiple Leviton Energy Monitoring HUBs/Properties.

b. Software shall support unlimited number of meter data points based on subscription level.

3. Software shall be used for the collection, analysis, and reporting of energy data from sub-metering equipment used to capture energy usage measurements that include, but are not limited to, electrical, gas, water, steam & BTU values

4. Software shall collect and report data in intervals 15 minute intervals by default; other user defined intervals available.

5. Software shall produce configurable reports and display data for all engineering units available from the meters incorporated into the system; kWh, kW, gallons, BTU.hr, etc.

6. Software shall allow for exportable tabular data in all report options; excel, .csv, etc.

7. Software shall allow for graphical representations of data in 15-minute intervals or other intervals as determined by the end user.

8. Software shall allow for the creation of virtual meter points.

9. Platform will allow for the creation of user defined dashboards.

10. Software shall allow for a Date Picking capability to allow for reports to be selected from the following time options:

a. Last Hour, 8Hrs, Today, Yesterday, 7 days, Week, 30 days, Month, Last Month, Last 12 Months, This Year, Last Year
b. User Defined Custom Period including date and time range as narrow as a single 15 minute interval

11. Report Header will display the range of total available data for the meter assigned to the report

12. Software will allow for the creation of user defined alarms for low and high readings for energy metrics reported on meters within the system.

2.15 PRODUCT REQUIREMENTS – EEM SOFTWARE-BMO ADVANCED REPORTING MODULE

1. Description: BMO Advanced Reporting Module is an Enterprise Energy Management software platform designed to assist energy and facility managers in the conduct of daily energy management reporting and analysis functions. It is designed for portfolio level use incorporating a wide range of graphical interfaces and an executive dashboard for high level energy information.

2. Provide a web hosted software platform which is fully functional without software other than standard web browsers including, but not limited to, Microsoft Internet Explorer, Google Chrome and Firefox Mozilla

3. Software shall support an unlimited number of separate locations/facilities and an unlimited number of data points per facility, based on user subscription level.

4. Software shall allow for unique facility information to be entered on Building Set Up Page to include:

a. Facility Address Information

b. Facility Square Footage
c. Utility Cost Information

5. Software shall be used for the collection, analysis, and reporting of energy data from sub-metering equipment used to capture energy usage measurements that include, but are not limited to, electrical, gas, water, steam & BTU values

6. Software shall collect and report data in intervals 15-minute intervals by default; other user defined intervals available.

7. Software shall produce configurable reports and display data for all engineering units available from the meters incorporated in to the system; kWh, kW, gallons, BTU.hr, etc.

8. Software shall allow for exportable tabular data in all report options; excel, .csv, etc.

9. Software shall allow for a wide variety of graphical representations of data in the following options:
   a. Line Charts
   b. Bar Charts
   c. Area Charts

10. Software shall allow for graphical data to be displayed in the following time interval options:
    a. 15 minute
    b. One day
    c. One week
    d. One month
    e. One year
    f. Custom User Defined Interval

11. Software shall allow for a Date Picking capability to allow for reports to be selected from the following time options:
    a. Last Hour, 8Hrs, Today, Yesterday, 7 days, Week, 30 days, Month, Last Month, Last 12 Months, This Year, Last Year
    b. User Defined Custom Period including date and time range as narrow as a single 15 minute interval

12. Report Header will display the range of total available date for the meter or virtual meter assigned to the report. Will also make tabular data available via selector tool.

13. Software shall organize all user defined and pre-configured reports to be cataloged on a building specific dashboard including the following basic information:
    a. Street Map pinpointing the buildings geographic location
    b. Local current weather conditions displayed

14. Software shall allow for the construction of Virtual Meters with the following parameters:
    a. Any number of like kind data points (kWh + kWh, etc)
    b. Combinations of data points from any HUB found in the software license
    c. Combinations of virtual meters to create an additional virtual meter.
    d. Virtual meter point data begins on the date and time the VM is created.

15. Software shall allow the creation of energy information alerts with the following parameters:
    a. Alerts shall be either consumption or demand based
    b. Alerts shall be based on high and low limits configured by end user.
    c. Alerts will be configured to allow communications via the following methods:
        i. Text
        ii. Email
16. Software shall allow for the creation of configurable Kiosks for public display of Energy Information. Energy data configured for display will be updated every 15 minutes or at other user defined intervals.

17. Software will allow for the following specific report types for advanced reporting and analytics:
    a. After Hours Consumption Reporting
    b. Drift Analysis
    c. Multi-Utility Parameter Report
    d. Electric Service Tree Report-Power Distribution Mapping
    e. Daily Heat Map-Energy Intensity
    f. Hourly Heat Map-Energy Intensity
    g. Rate Schedule Builder

18. BMO Base module functionality will be enabled in conjunction with this module.

2.19 PRODUCT REQUIREMENTS – BMO TENANT BILLING MODULE

1. Description: BMO Tenant Billing Module is a cloud-based software platform designed to allow multi-unit property operators to collect meter data and create utility invoices for commercial and or residential tenants.

2. Provide a web hosted software platform which is fully functional without software other than standard web browsers including, but not limited to, Microsoft Internet Explorer, Google Chrome and Firefox Mozilla

    a. Software shall support unlimited number of buildings or facilities with unlimited meter data points based on end user subscription level.

3. Software shall allow for unique facility information to be entered on Building Set Up Page to include:

    a. Facility Address Information
    b. Rate and Tariff Information
    c. Utility Cost Information
    d. Remit to address
    e. Disclaimers
    f. Custom Logo for Utility Invoices

4. Software shall be used for the collection, analysis, and reporting of energy data from sub-metering equipment used to capture energy usage measurements that include, but are not limited to, electrical, gas, water, steam & BTU values

5. Software shall collect and report data in intervals 15 minute intervals by default; other user defined intervals available.

6. Software shall allow for creation of a tenant list which includes all tenant information to include basic contact information for billing purposes. It will allow for assignment to a specific unit/apartment and include move in and move out date information.

7. Software shall allow for the construction of Virtual Meters with the following parameters:
   a. Any number of like kind data points (kWh + kWh, etc)
   b. Combinations of data points from any HUB found in the software license
   c. Combinations of virtual meters to create an additional virtual meter.
   d. Virtual meter point data begins on the date and time the VM is created.

8. Software shall allow meters to be assigned directly to apts/units within the database. Multiple utility meters may assigned to an apt/unit from the following list of types:
   i. Electric-kWh
   ii. Electric-kW
   iii. Gas/Propane
   iv. Steam
   v. Water
   vi. BTU
   vii. Common Area Electric-kWh

9. Software shall allow for the creation of the following types of billing tariffs:
   a. Simple Tiered Tariff with Demand
      i. Tiered Energy Usage-kWh
      ii. Tiered Energy Demand-Kw
      iii. Custom & Other Utility Charges
   b. Time of Use Tariff for Consumption and Demand
      i. TOU for Energy Usage-kWh
      ii. TOU for Energy Demand-kW
      iii. TOU Holiday Schedules
      iv. Peak Demand
      v. Custom and Other Utility Charges
   c. Software will allow for creation of multiple tariffs that can be activated and deactivated as required seasonally by the end user.
   d. Software will allow for different tariffs to be assigned to different buildings within the database.

10. Software shall allow for the creation of tenant invoices for user defined billing periods.
    a. The tenant invoices will contain the following data:
       i. Tenant Information; Name, Address, etc
       ii. Bill Date
       iii. Bill Period
       iv. Due By Date
       v. Meter Readings
       vi. Energy Usage and Charges
       vii. Custom Charges
       viii. Total Charges
       ix. Remit to Address
    b. Tenant Invoices will be created in .pdf format for download, export or print for delivery to tenants.

c. Tenant Invoice delivery options will include email delivery.

11. Software shall allow for Summary Billing Reports for each billing period.
    a. The summary reports available include the following:
        i. Tenant ID Information
        ii. Energy Usage Data
        iii. Rate Structure Summary
        iv. Total Utility Costs
        v. Costs for Custom Charges
        vi. Total Costs for all fields

12. BMO Base Module & Advanced Reporting Module functionality will be enabled with this software module.

PART 3.0 – EXECUTION

3.1 WIRING AND CONNECTIONS

1. All wiring must meet and or exceed local electrical code.

2. Metering points show on submitted drawings only to be connected or installed

3. Install all wiring in conduit.

4. Provide a non-dedicated or Ethernet drop for remote meter reading and diagnostics of the system

5. Perform all necessary system calibration, testing, commissioning, and demonstrations as required

6. Prepare and submit record drawings and installation, operation and maintenance manuals for the energy management system as required.

3.2 TESTING AND COMMIISSIONING

1. Perform final testing, adjustment, and commissioning of the systems, report results to the Consultant, and include the results in the installation, operation, and maintenance manuals. Provide qualified technicians for testing and commissioning.

2. Perform sufficient technical and operational tests to ensure the technical performance of the system meets the intent of the Contract Documents. Typical testing to include but not be limited to:
    a. Verification of meter readings and proper installation of meter equipment
    b. Communication system connectivity
    c. Meter communication with all software platforms

3. Provide optional functional testing including end to end verification that all meters are operating properly.

4. Demonstrate the operation of the system to the Owner at a time suitable to them. Such demonstration to include product training on how to program the monitoring system.

3.3 FIELD VERIFICATION, ACCEPTANCE, AND TRAINING

1. Provide all “AS BUILT” DRAWINGS and data showing each meter, serial number, address, cross reference, load and CT ratio prior to field verification.

2. Manufacturer’s representative shall verify, adjust and test the system. Verification of the energy monitoring system is to be carried out with the assistance of an electrical contractor at all times. Upon completion, the manufacturer shall issue a “Commissioning Report” to the owner, electrical consultant, contractor and client.

3. Manufacturer’s representative shall demonstrate operation of the system as follows:

    a. Local and remote meter readings
    b. Phase diagnostics
    c. Provide manual of the installed system
    d. Ensure system is connected to the cloud as required to communicate with software servers.

4. Software training is typically completed remotely via on-line instruction by Leviton technical support.

3.4 FIELD QUALITY CONTROL

1. Submit a detailed testing and commissioning procedure to the Consultant and Client for review and approval prior to undertaking this Work. The procedure shall indicate all test equipment required and acceptance criteria.

2. Upon completion of all testing and commissioning, submit a copy of the test results and certify the system as acceptable for revenue metering purposes.

3. Undertake the testing and commissioning Work with the manufacturer's factory representative(s).

3.5 INSTRUCTION TO STAFF

1. Upon completion of the installation, a competent instructor representing the system manufacturer shall provide a lecture to the operating and maintenance staff concerning the intent, use, and operation and maintenance of the system. This may be accomplished remotely.

End of Section