Metering for today’s systems
The sub-meter gathers data on the “building side” of the utility company meter.

This allows us to break out usage so data can be collected from individual circuits, a single tenant, equipment loads such as HVAC, motors, pumps, elevators, entire panels or entire buildings.
Let’s define Sub-Metering

Sub-metering:

• It is simply the ability to accurately measure and allocate the energy usage and energy costs of multiple users from a single measured utility energy source.
• **Sub-metering** is just like a fueling station that has multiple pumps that can fill several vehicles simultaneously from one tank and individually measure the amount of fuel dispensed to each vehicle.

• Since every vehicle has a different size tank and each uses a different amount each time, it would not be fair to charge a flat rate by vehicle.
Why Sub-Meter?

• Energy Management and Energy Savings.

• Tenant billing; tenants pay for only the energy they use. Commercial buildings are a prime example.

• Energy costs can be distributed among all the users or cost centers in an industrial or commercial facility.

• Software can provide proof of usage for any tenant disputes.

• LEED (Leadership in Energy and Environmental Design) using Measurement and Verification of usage.
What can be Sub-Metered?

- Electric (our primary meter)
- Gas or Compressed Air
- Water
- Chilled and Hot water flow
- Steam or BTU’s
- Fluids of any type
- Temperature and Humidity
Who needs Sub-Metering?

• Energy management and building automation systems.
• Commercial tenants for tenant billing.
• Retail Vendors. (Malls and shopping centers)
• Industrial applications: motors, chillers, conveyors, presses, production lines, etc.
• Marinas, campgrounds and fairgrounds
• Airports and tenants in them
• Private and K-12 Schools, Colleges and Universities
• Government Buildings
Energy Terms

- kwh = unit of energy, consumption
- kW = active power, real power
- Demand = highest kw load in a period of time, typically 15 minutes
- kVAr = reactive power
- kVA = apparent power
- PF = power factor = kW/kVA
Power Factor / Beer Analogy
(1) Mount the meter.
(2) Connect the voltage inputs using overload protection.
(3) Install the Current Sensors or Current Transformers.*
(4) Connect the Current Sensor wires.
(5) Turn on the voltage source.
(6) Set up the display according to the instruction manual.
Current Sensor Installation
Current Sensors vs. Current Transformers

• Current sensors have a voltage output (0-2 volt)
• Current transformers have a 5-amp output
• Current transformers require “shorting blocks” for safe installation and removal
• Current sensors can be run 500 feet or longer
• Can parallel up to 3 sets of current sensors
Single Phase kWh Meters

Class 1000-Single-Phase kWh Meter

- 120v, 1-phase, 2W
- 120/208-240v, 1 or 2-phase, 3W
- 277v, 1-phase, 2W
- From 25 amp to 200 amp

Optional NEMA 4X enclosure
3-phase kWh Demand Meters

Class 2000-Three-Phase kWh/Demand Meters

- 120/208-240v, 3-phase, 4W
- 240v, 480v, 3-phase, 3W
- 277/480v, 3-phase, 4W
- Sized from 100 amp to 3200 amp
Advanced or Smart Meters

• Smart meters provide communications and typically provide more advanced data than simple kwh

• In addition to kwh meters can also measure:
  – Volts per phase
  – Amps per phase
  – Real time load in kW
  – kW Demand
  – Power factor
Smart Meters

Class 3200
Advanced / kwh meter

- Available **RS-485** Protocols:
- Mod-Bus RTU, BACnet MSTP
- Built in Data storage (72 days)
- On board menu programing

- 277/480V, 3-Phase, 4W
- 120/208-240V, 3-Phase, 4W
- 600V, 3-Phase, 4W
Smart Meters

Class 3400-Advanced kWh/Demand Meter

- Dual communication protocols in two independent channels
- RS-485 channel & RJ45 channel

- 277/480V, 3-Phase, 4W
- 120/208-240V, 3-Phase, 4W
- 600V, 3-Phase, 4W
- From 100 Amp to 3200 Amp
Meter “Dashboard”

- Web-based graphical interface to display meter data
- Meter data graphically in “dashboard fashion”
- Can be customized to show energy cost in dollars or carbon footprint, for example
- Can be programmed for user defined “event alarms”
Power Quality / Logging Meter

- 4Mb onboard memory
- Date and time stamp of events
- Needed as proof of utility created issues
- Can email out or text on user defined alarms
- Requires 5A current trans.
- Requires enclosure or installed in existing equipment
Emon - Ohio Installations
Emon Specified Often

- Confidence – the leader in sub-metering for over 30 years.
- Installs fast, safely and takes little space.
- Reduces installation costs.
- Remote communication options: phone line, Ethernet, RS-485.
- Fully Automated Meter Reading using Emon Energy software.
- Easy BAS and EnMS integration.
Advantages of EMON

- Fully Electronic with a direct read 8 digit display.
- More accurate than the utility meter. (0.2% accuracy)
- Spilt – core current sensors standard.
- Quick installation.
- Requires significantly less space than a standard utility meter.
- Reduced cost of installation.
- No required maintenance.
- Can be read automatically with software.
- Easily interfaces with most BAS and EnMS systems.
The E-MON Split Core Current Sensor
The “Secret Sauce”
Multiple Meter Units (MMU)
Available with:
• Class 1000 and 2000 meters
• Class 3200 meters
Available in 8, 16, or 24 unit cabinets.
Commercial building engineer’s office
Emon Green Class Meter

It’s GREEN…

and has a scrolling display of electrical usage, cost of usage and CO₂ emissions
Display

Scrolling, 8 digit, direct read displays of:

- Kilowatt hours (kWh)
- kWh in dollars
- Current demand in kW
- Cost per hour, based on current load

![Digital Display Showing 1042.75]
Display

- Estimated CO$_2$ emissions in pounds, based on DOE data

- Estimated hourly CO$_2$ emissions based on current load.

- Optional net metering, including utility delivered vs. user-generated power (wind or solar) and net usage.
E-MON ENERGY™ SOFTWARE

• Provides the user the ability to read meters locally or remotely.
• The software can easily be configured to automatically read and download data.
• It has the best billing engine in the industry.
• It can read multiple locations from one software installation.
E-MON ENERGY™ SOFTWARE

- Reads E-Mon D-Mon® meters, either on-site or off-site, via modem (cellular or telephone), Ethernet or a directly connected computer.

- Reads all E-Mon D-Mon meters via IDR's and Class 3000 meters directly. Can also read gas, water, BTU and steam for billing purposes and graphical displays of usage.

- Exports data to spreadsheets for analysis (*.csv files).

- Meter reading and billing services are available for both E-Mon D-Mon and utility-type meters.

- E-Mon Energy™ software includes the USB connection key along with Factory startup and on site training.
Automated Billing
### Emon Energy Automatic Meter Reading Software

- **Total billing package:**
  - Tenant Billing
  - Cost Allocation
  - Energy Management
  - Time of Use

- Duplicate utility tariff
- Bill multiple services on 1 statement: gas, steam, water, btu

- **Automated meter reading and statement generation**

- Remote manual reads for off-cycle / move-in move out reads

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#### BILLING STATEMENT

**Durango's Restaurant**

<table>
<thead>
<tr>
<th>Meter Number: P-Durangos-1B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Number: 44B1</td>
</tr>
<tr>
<td>Billing Date: 05/16/01</td>
</tr>
<tr>
<td>Due Date: 05/30/01</td>
</tr>
<tr>
<td>Total Amount Due: $2,654.91</td>
</tr>
</tbody>
</table>

### Energy Use

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Meter Display</th>
<th>Actual kWh</th>
<th>Rate</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>on</td>
<td>0</td>
<td>3711</td>
<td>0.156000</td>
<td>578.92</td>
</tr>
<tr>
<td>mid</td>
<td>0</td>
<td>1685</td>
<td>0.081000</td>
<td>136.49</td>
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<tr>
<td>off</td>
<td>0</td>
<td>9342</td>
<td>0.065000</td>
<td>607.23</td>
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* Meter kWh Multiplier is 32

**Total kWh:** 14738

**Sub-Total:** $1,322.63

### Peak-Demand

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Peak Time</th>
<th>Peak kW</th>
<th>Actual kW</th>
<th>Rate</th>
<th>Charge</th>
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<tbody>
<tr>
<td>on</td>
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<td>56.00</td>
<td>56.00</td>
<td>12.2500</td>
<td>686.00</td>
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<td>mid</td>
<td>05/06/01 06:15</td>
<td>26.00</td>
<td>26.00</td>
<td>6.5000</td>
<td>169.00</td>
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<td>off</td>
<td>05/06/01 23:15</td>
<td>76.00</td>
<td>76.00</td>
<td>4.0000</td>
<td>304.00</td>
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</table>

**Coincidental**

| Distribution Demand | 0.00 |

**Sub-Total:** $1,159.00

### Other Charges

- **Type:** Service Charge
- **Basis:** 23.00

<table>
<thead>
<tr>
<th>Type</th>
<th>Basis</th>
<th>Rate</th>
<th>Charge</th>
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<tbody>
<tr>
<td>Service Charge</td>
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<td>23.00</td>
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<tr>
<td>Energy Adjustment</td>
<td>14738 kWh</td>
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**Sub-Total:** $23.00

### Total

<table>
<thead>
<tr>
<th>Total</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>$2,504.63</td>
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</table>

**Tax:** 6%

<table>
<thead>
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<th>Amount</th>
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<tbody>
<tr>
<td>$150.26</td>
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</tbody>
</table>

**Grand-Total:** $2,654.91
Do you need to sub-meter???

- There are unlimited uses for sub-metering well beyond tenant billing.
- Use the data provided for demand response or load shedding via an EMS or BAS system.
- Sub-Metering is an important component of an energy conservation plan.
- Energy conservation is quickly becoming a necessity.
- If you don’t monitor it, you don’t know where your energy is being used……or wasted!
Thank You!

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