UPS 101

Critical Power Infrastructures

Terminologies & Designations

Uninterruptible Power Supplies (UPS) have numerous labels:

1. **Backup Power Supply**
2. **Reserve Power**
3. **Battery Backup System**
4. **Standby Power**
5. **Emergency Power System**
6. **Stored Energy**

What is the function of a UPS?

Regardless of the verbiage, the overall function is the same:

1. Protect against short term power failures
2. Provide adequate power to allow for transfer to a long-term backup source
3. Provide adequate power to allow for graceful equipment shutdowns
4. Refine and regulate the quality of utility power

UPS Topologies Defined

Standby UPS – Utility Loss is somewhat Inconvenient:

A standby UPS' transfer switch is set to choose the filtered AC input as the primary power source (solid line path), and switches to the battery as the backup source should the primary source fail.

The inverter only starts when the power fails, hence the name "Standby.

Standby UPS' provide a measure of surge suppression and voltage regulation

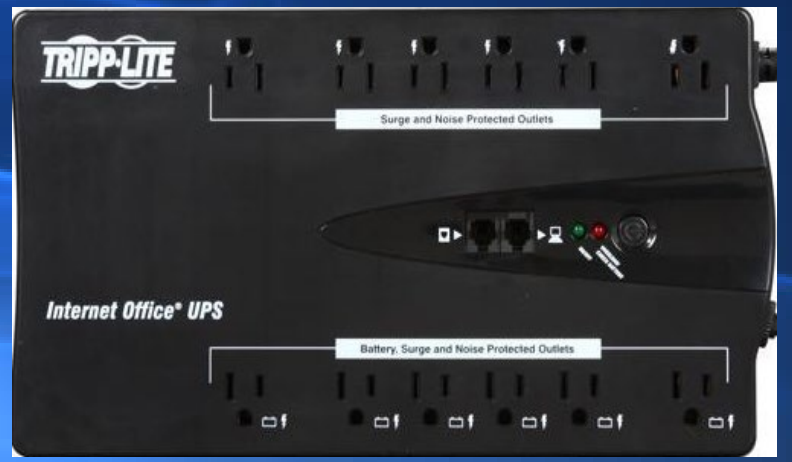
Low cost, highly efficient, small footprint

Utilizes battery for voltage regulation and power anomalies which can significantly shorten battery life and lead to failure

Standby UPS


On Line
On Battery
Overload
Replace Battery
Back-UPS
C S
6 5 0
APC
www.apc.com


EATON
3S 750
Battery Backup plus
Surge Protection
Surge Protection


TRIPP·LITE
Surge and Noise Protected Outlets
Internet Office® UPS
Battery, Surge and Noise Protected Outlets

UPS Topologies Defined

Line Interactive UPS (Utility Loss is Serious):

A line interactive UPS' inverter is always connected to the output of the UPS and the inverter will charge the batteries when the AC input is normal.

When power fails, power flows from the battery to the UPS output.

With the inverter always on and connected to the output, this design provides additional filtering

A line-interactive will provide solid voltage regulation which limits transfers to battery to regulate the power where a standby UPS utilizes the battery for the majority of power irregularities.

Line Interactive UPS

UPS Topologies Defined

Online Double Conversion – Utility Loss is Critical and Unacceptable

Online Double Conversion converts AC to DC then back to AC

In the Double Conversion On-Line design, failure of the input AC does not activate a transfer, because the input AC is NOT the primary source, but is rather the backup source. Therefore, during an input AC power failure, on-line operation results in no transfer time.

Since the AC power is constantly running through the UPS, the power is highly conditioned and regulated without utilizing the battery.

Higher upfront, operating and maintenance costs

Longer service life and scaling abilities

Online Double Conversion

Single Phase –vs- Three Phase UPS’

- Single-Phase UPS’s are standby or line-interactive topologies. They have low upfront costs, easy to install, user friendly, but for multiple loads can become expensive
- Single Phase UPS’s can be plug and play or hardwired with limited redundancy and capacity
- Three-Phase UPS require a licensed electrical contractor for installation but a properly designed electrical power system with a UPS and backup generator can pay large dividends over the long-term by reducing electrical power costs and plant downtime.
- With one three-phase UPS, all status and alarm functions can be monitored from a central point. To monitor the status of each single-phase UPS, they must be connected individually resulting in costly wiring runs.
- Three Phase UPS’ can result in lower maintenance costs than utilizing single phase systems due to the quantity and consumable replacements
- The majority of quality three-phase UPS’ are online double conversion or line interactive with pure sinewave.

UPS Topology Output Waveforms

The output waveform is dictated by the sine wave technology inherent to the UPS topology

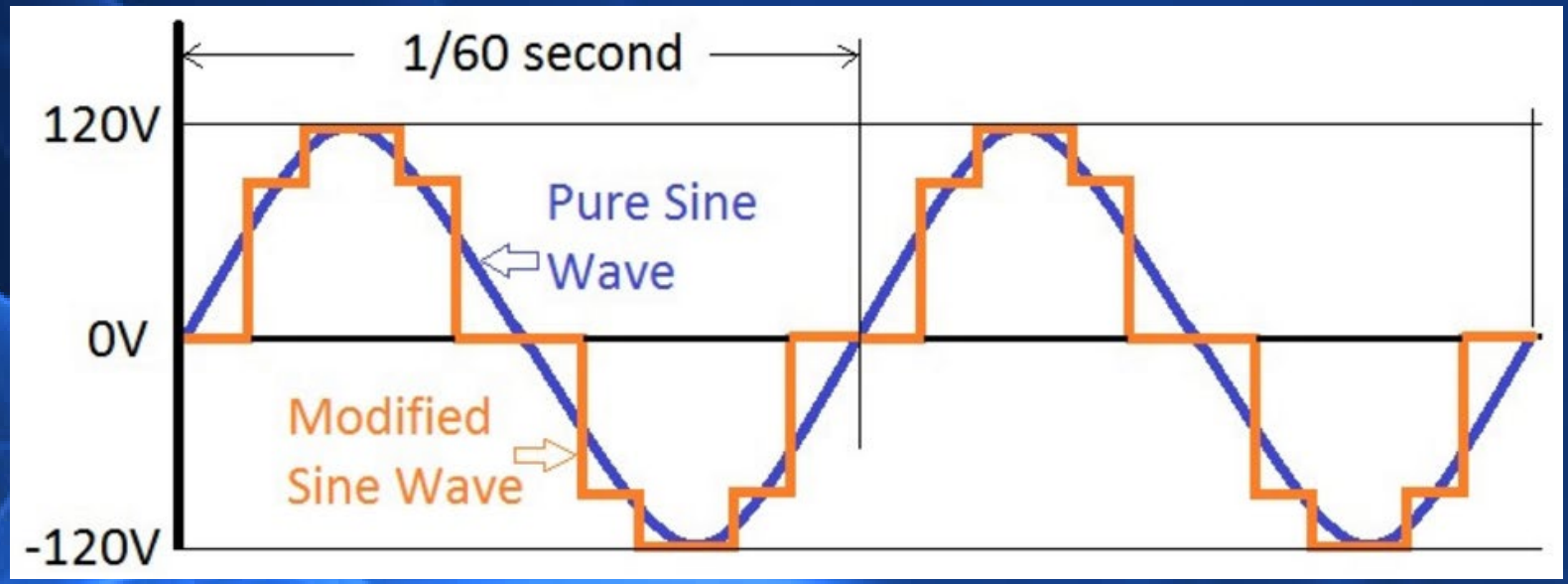
All online double conversion UPS' are pure sine wave technology

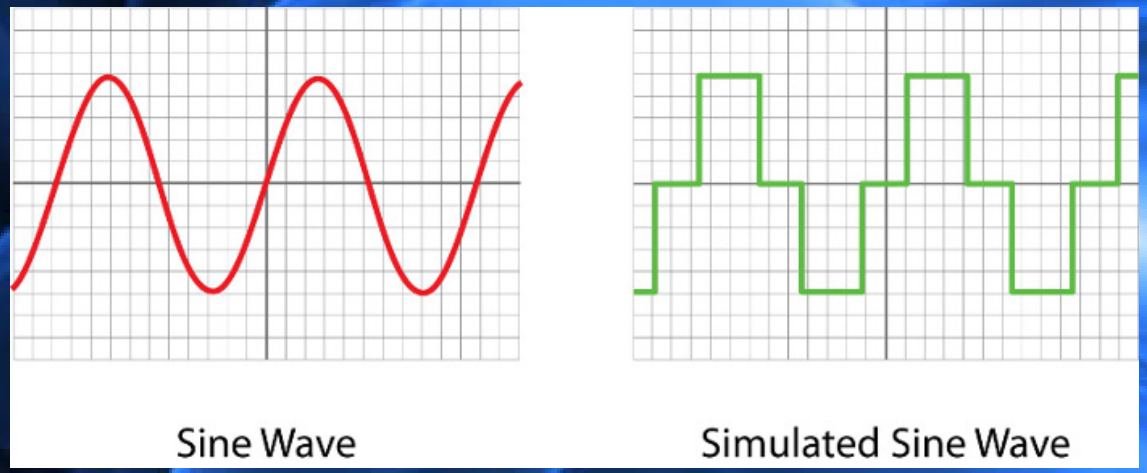
The Line Interactive technology is typically pure sine wave, however some of the lower level units are modified

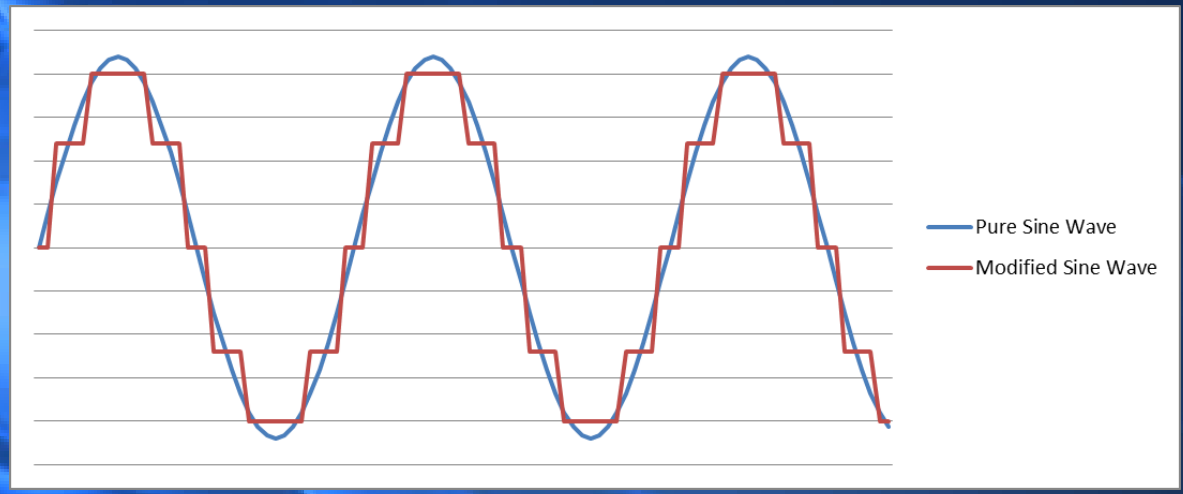
Standby or Offline UPS' are modified sine wave technology

The UPS AC output feeding the load can damage and impact the functionality of the supported equipment

Simple SineWave Comparisons







UPS's and Lighting Inverters - Is there a difference?

Uninterruptible Power Supplies are utilized for short term backup of the critical load for transfer, ride through or shutdowns. Historically, the systems were designed to provide 15 minutes of battery runtime, however, for infrastructures with long term backup (Generator), runtimes are steadily decreasing to 5 – 10 minutes.

Lighting Inverters are utilized for NFPA 101 life safety codes requiring (90) minutes of runtime to ensure exit lighting is provided in the event of an outage allowing occupants to exit the building safely.

Lighting Inverters Defined

1. Lighting Inverters; also referred to as Central Emergency Lighting or Life Safety Inverters. An inverter classified as life safety must be UL 924/NFPA 101 compliant requiring compliance with all of the following:
   a) 90-minutes of runtime at full load
   b) 30-second monthly functional test
   c) 90-minute annual discharge test
   d) System Maintenance conducive to upholding the code requirements

NFPA 101 - Cracking the Code

The National Fire Protection Agency (NFPA) requires the following for code compliance:

1. In the event of failure of normal lighting, 90-Minutes of emergency illumination shall be provided to ensure tenants are able to safely exit the building.
2. Exits include designated stairs, aisles, corridors, ramps, and escalators to a defined public way.
3. Documentation of completed testing for the previous 3 years must be available at all times for AHJ
4. A violation of life safety codes can incur heavy penalties, compliance testing dictated by the AHJ and in some cases can cause the entity to cease operations until compliance is reached
5. Lighting Inverters are available in single phase and 3 phase
6. Typically specified to be Online Double Conversion

Technologies of Lead Acid Batteries

1. VRLA – Valve Regulated Lead Acid - Sealed
   a. AGM Technology (Absorbed Glass Mat) Non-hazardous, Non-Spillable
   b. Can be installed in racks or cabinets, upright or on it's side
   c. 10 Year Design Life (4-6 Year Service Life)
   d. Lower capacity range, vulnerable to heat
   e. Charges up to 5 times faster than a flooded cell
   f. Minimal gassing allowing for decreased ventilation area
   g. Over 98% of lead acid batteries have recoverable components and over 80% of these components are utilized in the production of new batteries.
   h. Easier transport and less packaging/protection requirements

C&D TECHNOLOGIES
Power Solutions

EnerSys
Power/Full Solutions™

Narada

BATTERY
CSB

YUASA

NorthStar®
THE ULTRA HIGH PERFORMANCE BATTERY

825kVA / 750kW UPS – Redundant - (4) Strings of 730WPC Batteries per Line Up

Battery Strings will provide 9 minutes at full UPS Capacity to 1.67VPC

Battery Monitoring and Spill Containment Installed (Containment required per AHJ)

Technologies of Lead Acid Batteries

1. VLA – Vented Lead Acid - Flooded (Wet) Cell Battery
   a. Free flowing liquid – Spillable and Hazardous
   b. Requires adding water, hydrogen sensors, spill containment and expanded ventilation area
   c. 20-Year Design Life (14-16 Year Service Life)
   d. More tolerant in elevated temperatures and can endure/recover faster from abuse such as overcharging and high use
   e. Available in substantially higher capacities and footprints than VRLA
   f. Battery cases are historically clear allowing a full internal view
   g. Upright installation only
   h. Over 98% of lead acid batteries have recoverable components and over 80% of these components are utilized in the production of new batteries.


GNB Flooded
Classic


EXIDE G


SBS
P/N STT6V200


EAGLE EYE
power solutions


DANGER
data safe
D

Calculating Loads & Sizing UPS

Loads that SHOULD NEVER be placed on a UPS

1. Cooling of any kind (CRAH, CRAC)
2. Laser or Thermal Printers
3. Appliances – The microwave and coffee pot do not need to be backed up
4. Heaters or Heating Elements
5. Any inductive loads

The inherent nature of inductive loads causes an inrush to run through the UPS creating overloads, system bypass and load drop

Load Values: Real Power –vs- Apparent Power

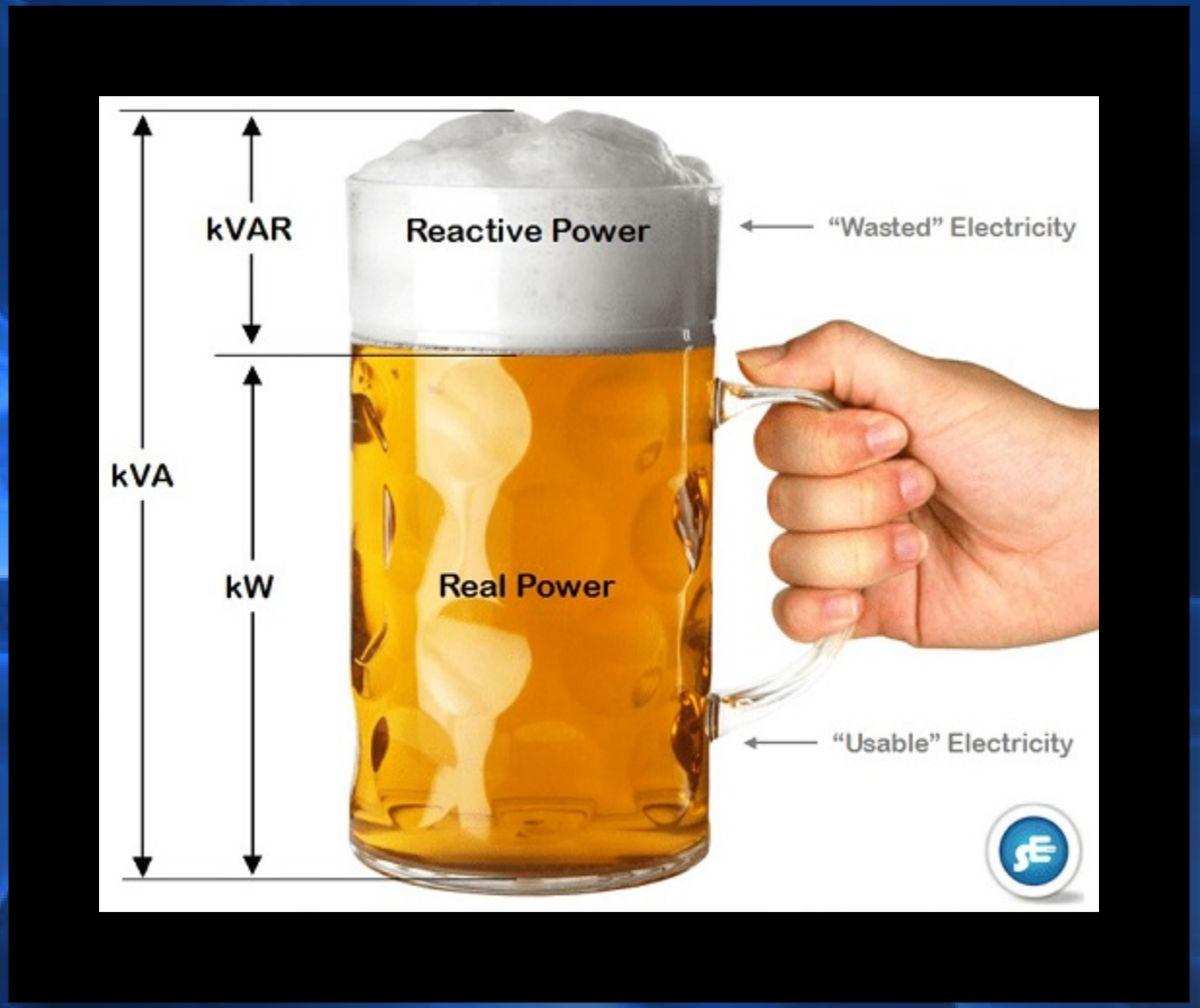
Apparent Power: VA/kVA - 100kVA (Power factor unidentified)

Real Power: Watts/kW - 80kW (Power Factor identified)

The difference between the two ratings is often misunderstood and can generate serious repercussions

1. If the equipment loads are measured in kVA, the UPS will likely be oversized causing:
   a. Increased and unnecessary upfront costs (Installation, UPS Capacity, Battery Strings, Maintenance and Consumable Replacements
   b. Increased operating costs: An oversized UPS is far less efficient, higher maintenance and consumable replacement costs

Power Factor Defined by Beer:



Maintenance, Maintenance, Maintenance

Every piece of equipment, regardless of the application, requires some amount of maintenance and power systems are no different. A backup system is only as reliable as the health of each component. A battery string is only as solid as it's worst jar.

Discovering an issue in the midst of a utility failure creates reactive responses, emergency calls, expensive repairs and possible load drop. Calculating the costs of an unplanned outage stretches beyond the system itself and does not take into account the loss in productivity, revenue, incurred fines and a damaged reputation.

Preventing System Failures

How do you prevent UPS System Failures?

Let's say it together……Maintenance!

A preventative approach to maintenance is simply defined as an implementation of critical services designed to identify potential issues BEFORE they become failures.

A comprehensive maintenance contract will provide preventative measures for UPS failures to include:

1. Visual Checks – Environment, temperature, connections, fans, caps and signs of any potential component stress or abnormalities
2. Operational Testing – Electrical and Mechanical system testing, transfer test, voltage & resistance readings and calibrations

Preventing UPS System Failures

Countdown of The Top 5 Common Causes of UPS and Battery Failures:

5. Power Supplies – A UPS can fail due to poor or faulty workmanship, transit damage, incorrect installation or the owner/operator.
4. Connections – Loose connections within the UPS or battery string can cause overheating, shorts and arcing which sets the stage for fires and failures.
3. Fans – Cools the UPS to avoid overheating. 7 to 10 Year life expectancy and fully replaceable.
2. Capacitors – Filters are responsible for smoothing out and filtering voltage fluctuations. 7 to 10 Year life expectancy and fully replaceable.

Capacitor Failures

.....And the Number One Cause of UPS System Failure?

Drum Roll Please.....

Preventing UPS System Failures

The Number One Cause of System Failure: BATTERIES!!!!!!

Despite the predictive measures available to trend the life cycle and health of the batteries, failures continue to occur due to a lack of proper maintenance and report analysis. As a result of continuous battery failures and the potential dangers that can occur, the IFC code focus has shifted from spill containment (Electrolyte leakage) to Thermal Runaway.

Preventative Maintenance Service Levels

There are (3) PM service levels the majority of service groups utilize and visits are expected to occur during the course of a 12 month period.

Major Minor & Quarterly

The scheduling of a PM may require an SOW or MOP to be submitted to the facility manager to notify tenants, employees and customers of the upcoming visit and the potential of power loss.

Documentation of the services completed (Field Service Reports) are in many cases a requirement for some industries (Data Centers, Medical, Education), which makes knowing the difference between a major and a minor is crucial.

There is an obvious cost difference and It's surprising how many minors are getting charged as majors. This not only cheats the customer, but provides limited information on the systems health and reliability.

Preventative Maintenance Service Levels

Quarterly Preventative Maintenance

A quarterly PM is considered minimally invasive and typically conducted during normal business hours. Frequently implemented to increase visibility and frequency of battery maintenance due to it's common cause for system failures.

A quarterly PM consists of visual inspections for the UPS with a heightened attention to the battery system. Increased maintenance visits are highly recommended for batteries reaching service life expectancy and can identify issues that may have developed since the last maintenance visit

Preventative Maintenance Service Levels

Minor Preventative Maintenance

Commonly referred to as a "semi-annual PM" is minimally invasive and primarily consisting of visual inspections and recordings to include:

1. Complete visual inspection of the UPS equipment, AC/DC Caps, subassemblies, wiring harnesses, contacts, cables, boards, fuses, etc.
2. Complete visual inspection of the battery housing, terminals, interconnects and torque
3. Record all voltage and current meter readings on the UPS module
4. Measure and record harmonic trap filter currents
5. Measure and record phase-to-phase input voltage and currents
6. Review and interpret diagnostic alarm history

Preventative Maintenance Service Levels

Major Preventative Maintenance

Commonly referred to as an "Annual PM", is the most comprehensive PM visit. It's considered invasive and is typically conducted after normal business hours. A Major PM consists of all minor checks, however, full functionality testing must also be conducted and includes:

1. Operational / Transfer Testing:
    a. Mains Transfer Test- Run module at normal load and switch UPS main input on and off
    b. Battery Transfer Test – Run module at normal load and open UPS main battery breaker to transfer load to battery and return to normal.
    c. Load Transfer Test – Run module at normal load and switch UPS off and on until load is on static bypass and return to UPS
    d. Bypass Transfer Test – Transfer load from UPS to external bypass and return to UPS

Preventative Maintenance & Thermal Runaway

Thermal runaway occurs when the heat generated in a lead-acid cell exceeds its ability to dissipate that heat, which can lead to an explosion. This condition not only affects the specific battery, but will impact the entire string. In extreme cases, adjacent batteries and/or equipment can also be severely damaged requiring costly cleanup, repairs and replacements. And extensive downtime.

THIS CONDITION DOES NOT HAPPEN OVERNIGHT AND IS NOT MANUFACTURER OR APPLICATION SPECIFIC. Having a knowledgeable and experienced technician performing consistent maintenance will identify the potential signs BEFORE failures occur.

Maintenance Bypass Types

1. Static Bypass: Should the inverter fail, the bypass ensures the load drops automatically onto the mains input feed
2. Maintenance or Wrap Around Bypass: Installed external to the UPS and enables the UPS to be isolated for maintenance or repair without interrupting power to the load
    a. Break-Before-Make: Configured to break (open) the first set of contacts before engaging (closing) the new contacts. This prevents the momentary connection of the old and new signal paths.
    b. Make-Before-Break: Configured to establish the new connection path before the previous contacts are opened. This prevents the switched path from ever seeing an open circuit.

Battery Runtime Expectations and Reality

When calculating battery runtime, several factors must be taken into consideration:

1. True size of critical load – What needs to be supported during an outage and what does not.
2. Required data to accurately size battery capacity:
   a. What is the application and installation environment?
   b. True load in watts/kW
   c. Is there a long term power source in place?
   d. Space, weight and installation area availability and limits.
   e. Expectation of growth or decline?
   f. Money and budgetary restraints

Battery Runtime Expectations and Reality

3. Examples of items that impact battery sizing:
   a. Load value and UPS Capacity presented in kVA
   b. Load value provided includes every piece of equipment
   c. Requested runtime is based on duration of an outage
   d. Runtime based on the full UPS capacity, not current or expected load
   e. Installation environment
   f. Unfamiliar with local and state regulations

Battery & UPS Sizing – What We Need to Know

Your UPS needs batteries. We got batteries. But we need a little information first:

1. UPS Manufacturer Make and Model – (if existing) If new system - load + voltage
2. UPS Capacity (Let us know if the UPS has capacity upgrade abilities)
3. Battery Runtime Request (UPS Capacity, Existing Capacity, Lower Capacity?)
4. New UPS or Replacements for Existing
5. Racks or Cabinets? Top or Front Terminal? Space Restraints? Battery Design/chemistry? Redundancy? Code Compliance? Site Conditions?
6. If replacing existing batteries, we need the battery make/model and enclosure information. If they don't fit……Tony is not amused.

Battery Sizing – What We Need to Know

The most efficient, accurate and my favorite way to relay this information to us:

Take pictures!!

All equipment has nameplates, or did, with very detailed information that is extremely helpful.

1. UPS nameplates are typically located on the inside front panel, usually on the right side or in the rear. If the manual happens to be around, this information may also be included in the documentation

2. Battery Cabinet nameplates are also typically located on the inside front panel at the bottom or either side.

1. Battery Rack nameplates are present, but at times very difficult to locate or read.
   When in doubt……give us a call! We will conduct a site survey and gather all the information we need and design the system based on all the relevant factors.

When In Doubt……

- When in doubt……give us a call! We will conduct a site survey and gather all the information we need to design the system based on all the relevant factors.
- Sizing a UPS and Battery Bank requires a multitude of equations, considerations, measurements, calculations and decades of experience and knowledge. Our wisdom derived from lessons that we will NEVER EVER make again!

Let us take the stress and guesswork out of power generation.

Cost Comparisons for Battery Systems

Example 1:

200kW Load – 480VDC – 15 Minutes Runtime at full load

(2) Strings (80 Jars) consisting of 505WPC Batteries 8,240Lbs.

(2) Enclosures, Breakers & Cabling 84"W x 29.5"D x 78.7"H 1,400 lbs.

Example 2:

200kW Load – 480VDC – 10 Minutes at full load

(2) Strings (80 Jars) consisting of 350WPC Batteries 5,392 Lbs.

(2) Enclosures, Breakers & Cabling 84"W x 29.5"D x 78.7"H 1,400 lbs.

Cost comparisons for Battery Systems

Example 3:

200kW Load – 480VDC – 5 Minutes Runtime at full load

(1) String (40 Jars) consisting of 540WPC Batteries 4,000Lbs.

(1) Enclosure, Breaker & Cabling 40"W x 29.5"D x 78.7"H 700 lbs.

Comparisons in Cost & Footprint

Comparison with 15 Minute Runtime:

1. 22% higher cost than 10 minute – 47% higher cost than 5 minute
2. 10 minute same – 40” Wider (50%) than 5 minute
3. 30% heavier than 10 minute – 51% Heavier than 5 minute
4. 30% higher replacement cost than 10 minute – 46% higher than 5 minute

Cost comparisons do not include freight, Installation, cooling, etc.

*Equipment Only

Design Life – VS – Service Life

A Common Misconception that Requires Clarification

Batteries:

As previously discussed, the technology of a battery will dictate the design life. Loosely defined, the design life is calculated based on all of the following and then some:

1. The batteries are not exposed to lengthy or deep discharges of any frequency
2. The batteries are at a constant ambient temperature of 77°F with zero deviation
3. The batteries must have adequate ventilation based on space/quantity/capacity
4. The batteries are not undersized based on load and runtime
5. Batteries are float charged at manufacturers specifications with zero deviation
6. Batteries are properly and consistently being maintained to manufactures specifications

Design Life – VS – Service Life

Batteries

So what can be done to capture the design life expectancy?

Never Use Them

Yes, it really is that simple

System Monitoring

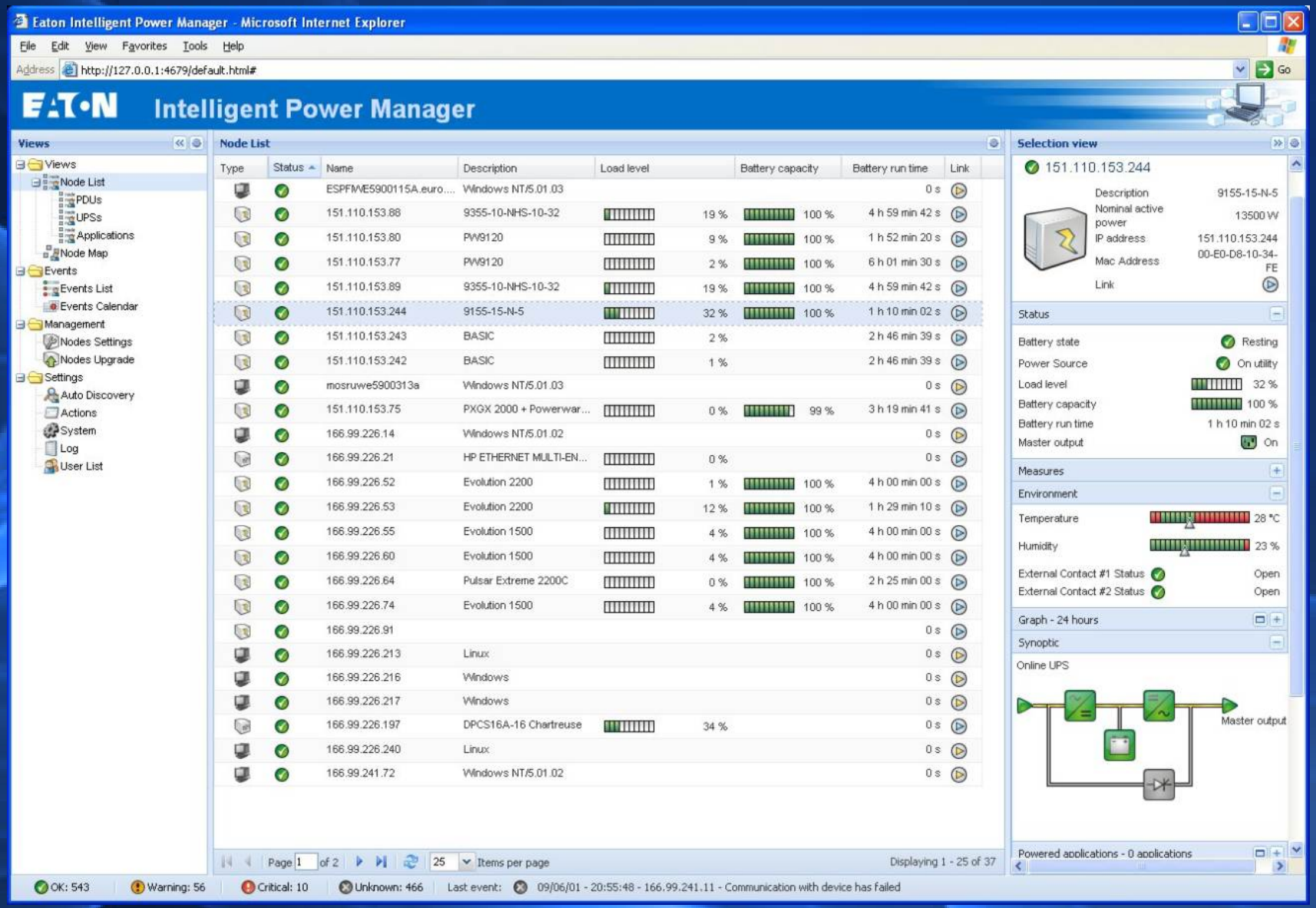
Benefits:

1. One primary advantage of system monitoring is the 7X24X365 visibility and notification traps of current or potential issues that may have been overlooked, developed between maintenance visits or the lack of maintenance
2. A second primary advantage are the trending abilities battery monitoring can provide
    1. Create a baseline upon installation or major preventative maintenance visit
    2. Analyze historical data and graphs to identify patterns and find problems quickly
    3. Warranty Claims
    4. Appropriate reports for required documentation
    5. Identify the rate of a batteries declining health for replacement projections, budgeting and NO UNPLANNED OUTAGES!

System Monitoring

1. UPS Monitoring: The majority of UPS manufacturers include some sort of basic system monitoring in the bill of material for a very low cost. The typical features included in this type of software:
   a. Web-enabled monitoring of UPS data (remote access to monitoring - SNMP/Modbus)
   b. Event and system logs
   c. Email notification with parameter options
   d. Shutdown abilities (Load Shedding)
   e. Monitoring Points: UPS Status (Input Current, Voltage, Frequency, Battery Status, Load, etc.)
   f. Integration with BMS or additional systems onsite

Example of UPS Monitoring



System Monitoring

1. Battery Monitoring: We have established that the most common cause of system failures are the batteries. It makes sense to put a system in place to provide 7X24X365 monitoring to identify any potential failures that may have developed between maintenance visits or the lack of maintenance.

Typical features and data points:

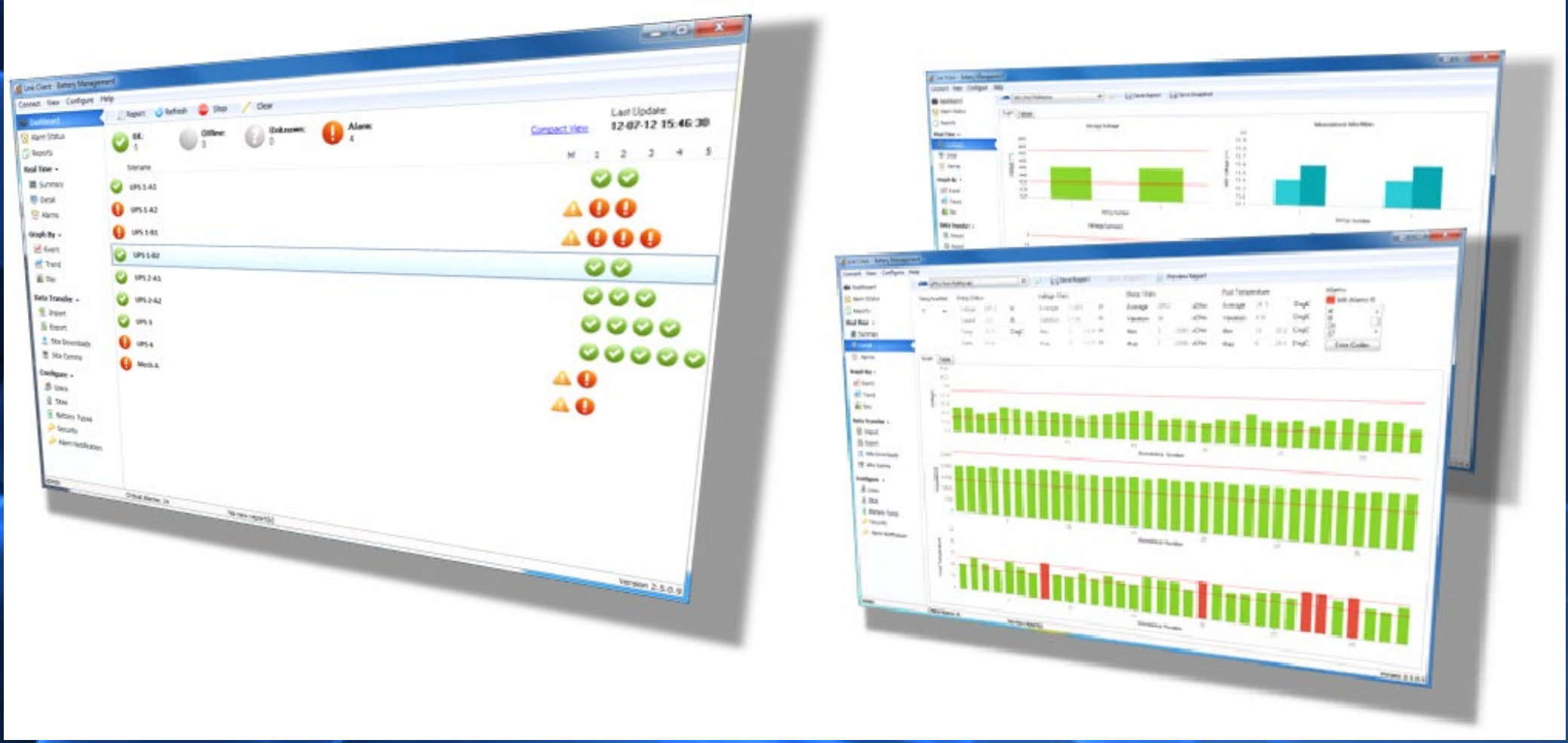
a. Monitoring can occur at the string level or the jar level
b. Impedance (ohmic value)
c. Voltage
d. Temperature (Battery and Ambient)

Battery Monitoring has also evolved to include devices for Compliance of Code IFC 608.3 and in some cases, battery monitoring has identified issues with the UPS such as failing capacitors.

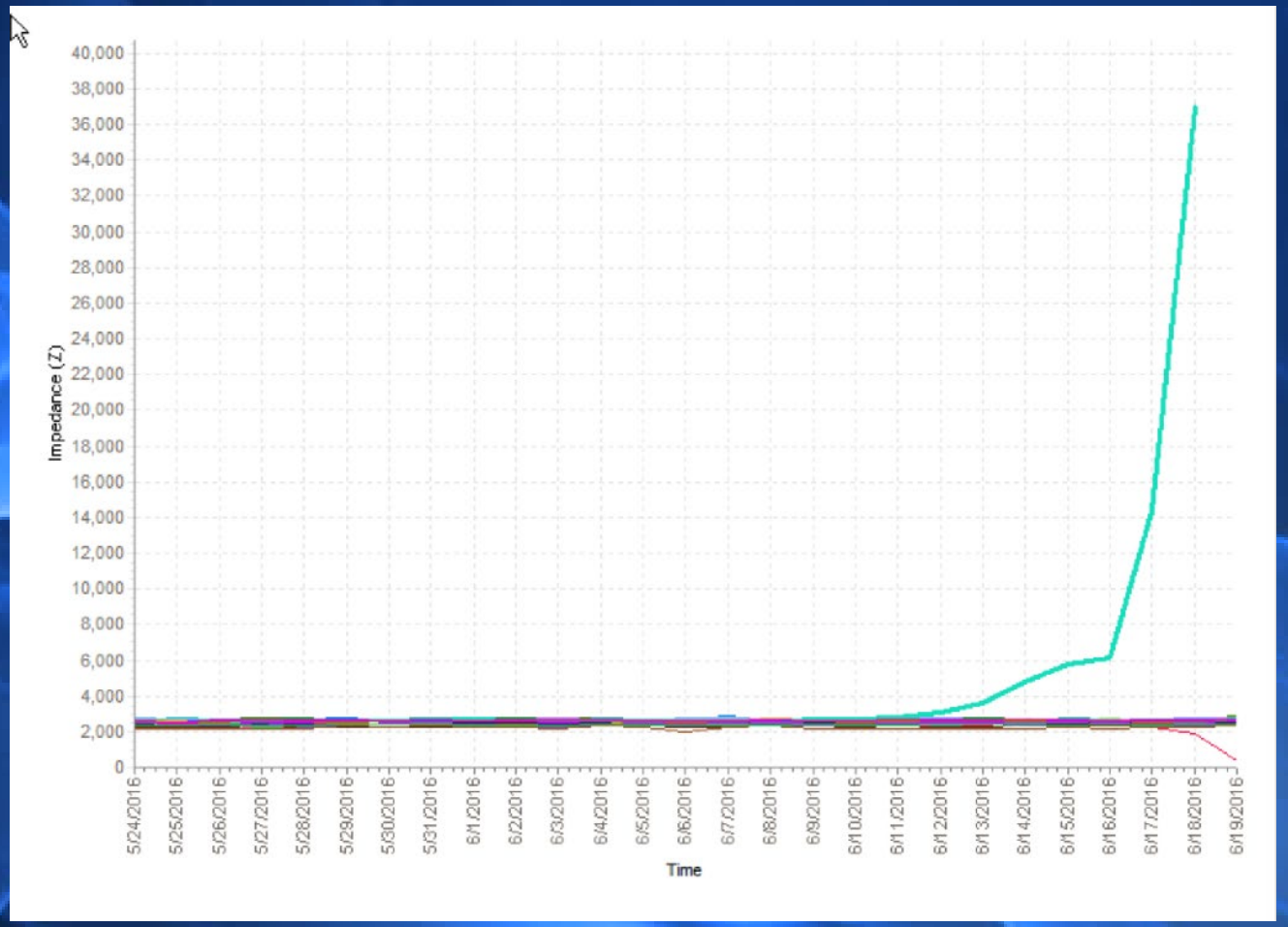
Battery Monitoring

1. Most battery monitoring systems accommodate multiple sites with an unlimited or a substantial quantity of batteries
    1. A single party can view remotely the status of any battery at any site from one location on the network
    2. As a service group, viewing the status of any battery PRIOR to arrival for maintenance offers detailed, real time status allowing technicians to arrive onsite with a replacement battery(ies) that can be tied in with the existing change control maintenance window.

Example of Battery Monitoring



Battery failure captured by battery monitoring. The last PM performed on this string was 6/10 and the battery failed on 6/16. Without battery monitoring, this string would have been rendered useless during an outage, causing serious repercussions and $$$$$! With this information in hand, we were able to remedy the issue immediately and eliminate damage to the remaining jars



System Monitoring - ROI

What is the Return on Investment (ROI) for adding monitoring?

1. As discussed previously, the ability to identify issues prior to a scheduled visit allows the service group to arrive onsite prepared for the corrective service. This eliminates:

    1. Rescheduling the initial visit
    2. Scheduling an additional or follow up visit to perform corrective measures
    3. Remedies the situation rapidly so additional damage can be mitigated
    4. Provides the customer the ability to request emergency change orders or extended maintenance windows immediately.

System Monitoring - ROI

With the benefits of monitoring having been established, how does that equate to $$$?

<u>Scenario 1</u>

Let's assume the cost for a scheduled Major PM (After Hours) is $1,000.00

Service Group identifies a battery issue via monitoring PRIOR to dispatch

Technician notifies customer of the issue and is given permission to replace the battery during the course of the scheduled maintenance

If there is a cost incurred for the battery itself, we will use $150.00

Total cost for corrective maintenance: $150.00 (The Major PM is paid upfront)

System Monitoring - ROI

Scenario 2

Let's assume the cost for a scheduled Major PM (After Hours) is $1,000.00

Service Group identifies a battery issue upon arrival

Technician notifies customer of the issue and is not given permission to replace the battery during the course of the scheduled maintenance due to notification regulations

Technician performs the Major PM as scheduled and may jumper out the battery until corrective visit can be scheduled. This will affect the battery runtime and requires lowering of the float voltage on the UPS

Assume cost for scheduling a corrective visit (After Hours) $900.00

If there is a cost incurred for the battery itself, we will use $150.00

Total cost for corrective maintenance: $1,050.00 (The Major PM is paid for)

System Monitoring – ROI

The Scenario Costs:

Scenario 1: Combined Services $150.00

Scenario 2: 2nd Visit $1,050.00

If the customer has (2) UPS' and over the course of 5 years, each UPS requires (2) Corrective Unscheduled Maintenance Visits

The increase in maintenance costs for those (2) units is $3,600.00

How much does downtime cost? It's more than you think……

System Monitoring – ROI – Cost of Downtime

In addition to the increase in maintenance costs, there is also the dreaded

"Cost of Downtime"

A single hour of downtime – Wages Only !:

98% of organizations say one hour of downtime costs over $100,000

81% of organizations say one hour of downtime costs over $300,000

33% of organizations say one hour of downtime costs $1-5 million

System Monitoring – ROI – Small Business

If a business has 100 employees, each making $30/hour with one hour of utility loss

Total NBH labor cost $3,000.00. Employees get paid whether utility is up or down

Recovery NBH labor cost $3,000.00 – If productivity loss can be rectified within NBH

Recovery ABH labor cost $4,500.00 – If productivity loss will require AH

Recovery PABH labor cost $6,000.00 – If Sundays and/or holidays are required

System Monitoring – ROI – Medium Business

If a business has 200 employees, each making $30/hour with one hour of utility loss

Total NBH labor cost $6,000.00. Employees get paid whether utility is up or down

Recovery NBH labor cost $6,000.00 – If productivity loss can be rectified within NBH

Recovery ABH labor cost $9,000.00 – If productivity loss will require AH

Recovery PAH labor cost $12,000.00 – If Sundays and/or holidays are required

One Hour of Downtime

To summarize:

The labor wage cost of One hour of downtime for 100 employees

1. NBH: $3,000.00 / ABH: $4,500.00 / PAH: $6,000.00

The labor wage cost of One hour of downtime for 200 employees

1. NBH: $6,000.00 / ABH: $9,000.00 / PAH: $12,000.00

Keep in mind that the costs for loss in revenue, overhead and recovery are above and beyond the basic wages and can be staggering

System Accessories

1. Spares On Site Battery Systems: Small integrated battery cabinets to house spare batteries at the customer site for immediate access. Can accommodate 2V – 16V jars, Mixed AH/WPC ratings with capacity to hold from 6 to 12 batteries based on footprint.

2. Spare Parts Kit: Whether you have a parts inclusive contract or not, having access to equipment parts onsite will decrease maintenance costs and repair time. As opposed to ordering parts, awaiting arrival, rescheduling visit…and yes… DOWNTIME!!

Spares On Site Battery Systems

Store fully charged replacement batteries for all your mission critical power backup equipment including Uninterruptible Power Supplies, Emergency Lighting Inverters & DC Power Plants

Batteries to Spare Systems are Fully Mobile and Customizable

Various AH/WPC battery capacities of the same voltage in a single enclosure

Operates from any 120V outlet with 10 Ft. line cord

<u>Additional Products</u>

BTS Big Boy – Stationary Cabinet System for higher battery

Powerhouse Generator Jump Start Cart

System Accessories

2. Sensors: In addition to monitoring systems, additional sensors can be added for heightened assurance or code compliance. Examples: Humidity, Door Switch, Fluid and Smoke

2. Transient Voltage Surge Suppression/Surge Protection Device
   A transient surge is a short blast or pulse of high energy that can either come in its natural form such as lightning or produced by other equipment onsite. The TVSS device absorbs or diverts all the energy present in the surge and clamping the "let through" over voltage down to a level safe for exposed circuitry. The majority of surges are internally generated by the facility

TVSS – Transient Voltage Surge Suppression

Refurbished, Refresh or Replacement

Refurbished Equipment: Used equipment is tested and repaired for the purpose of reusing at another location or customer.

Refreshed Equipment: Updating existing customer equipment by replacing consumables, increasing/decreasing system capacity, updating software/firmware or performing tasks that can extend the life and health of the system

Replacement Equipment: Removal of existing UPS and installation of new UPS based on current and anticipated future needs. It is likely things have changed since the original system was specified and a large quantity of our clients are able to scale down or purchase a scalable UPS

Refurbish, Refresh and Replacement – Pros & Cons

Refurbish:

Pros: Less upfront costs, usually low or no lead time, ideal for temporary or leasing needs and if appropriately tested/repaired can be paramount to a startup or small businesses

Cons: No warranty, older technology/discontinued, lack of parts availability, typically larger footprint & less efficient with minimal ability to "specify" the system you need.

Refresh:

Pros: System is already installed and functioning, typically lower cost than replacement or refurbish, buy time for replacement and has potential to become a refurbished unit

Cons: No warranty, older technology, less efficient, parts become scarce rapidly, can become quite costly

Replace:

Pros: Factory Warranty, latest technology, specified and sized based on real time current and anticipated needs, accurate capacity = accurate battery, scalability, reduced footprint and highest efficiency.

Cons: Higher upfront equipment costs, installation and possible modification costs, lead time

EPA Certified Recycling

1. Lead Acid Batteries have a recycling rate of 99.3%, making them the No. 1 recycled consumer product in the U.S.
2. On average, a new lead battery is comprised of more than 80% recycled lead battery material.
3. Every part of the battery, from lead and plastic to sulfuric acid, is recyclable and reusable in manufacturing new batteries. This reduces the need for new lead mining, reduces waste and helps keep lead out of landfills.
4. Recycling of batteries occurs in prepaid truckloads (42,000 Lbs.) and require strict storage, packaging and transportation guidelines. Hazardous placards and additional insurance may be necessary for transport. Some battery technologies require a cost for recycling and can run from $1/Lb. to $4/Lb.

Questions? Comments?

Contact Us!

PALERMO

POWER SYSTEMS

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