Utilities Technology Council™

Powering Up Performance

Optimizing Reserve Power Battery Maintenance

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Agenda

1. Introduction: Battery Preventive Maintenance
2. Maintenance & replacement program challenges
3. How to optimize battery management?
4. Health-based replacement program
5. Traditional vs Automated Maintenance
6. BMS: Key Evaluation Criteria & implementation
7. Key Improvements
8. Q/A session

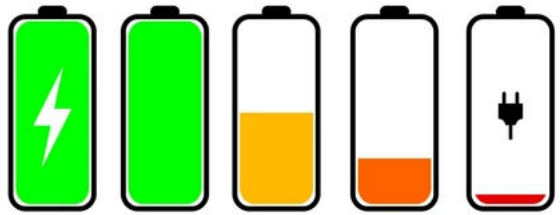
Introduction

- Battery systems play a vital role in protecting essential services.
- Failure of reserve power batteries can lead to:
  - Significant disruptions
  - Financial losses
  - Potential safety risks.
- Batteries are prone to:
  - Aging
  - Degradation
  - Unexpected failures.

Introduction

- Important to maintain VRLA batteries
  - IEEE 1188 best practices - Visual inspection / Annual Internal Ohmic Testing.
- Recommendation - Record Keeping & Trend Analysis:
  - Maintain detailed battery test logs for performance tracking.
  - Compare historical data to detect early failure trends.
- O&M dedicated budget:
  - Dedicated hours for technician testing.
  - Purchase and maintain battery tester fleet.

Battery Preventive Maintenance data is key to determine when to replace batteries



Maintenance & replacement program challenges

- **Manual processes:**
  - Scheduling maintenance activity.
  - Battery testing.
  - Dara manipulation
  - Health analysis (engineering team).
  - Replacement forecast.
- **PM Data Centralization:**
  - Data stored in internal repository
  - Difficulty to access historical data for analysis.
  - Difficulty to access trends.
- **Discrepancies in the data analysis:**
  - Process not standardized/homogeneous.
  - Employee, business unit or tester dependent.

Maintenance & replacement program challenges

- **Replacement program based on battery age:**
  - Replacement decision regardless of battery condition.
  - Can lead to unexpected failure.

How to optimize battery management?

Encourage the use of a centralize data base:

- DC asset inventory management.
- Store technical information on the battery:
  - ➢Manufacture discharge table.
  - ➢Ohmic reference value.
- Data manipulation (calculation):
  - ➢Battery reserve time.
  - ➢Battery state of health.
  - ➢Battery state of health derated by the state of health.

How to optimize battery management?

Drive Process Automation to Maximize Efficiency:

- Scheduling of the maintenance activity:
  - ➢Define dynamic period/interval.
- Import functionality:
  - ➢Leverage direct output from the tester (CSV format).
  - ➢Ability to modify Ohmic reference value with first PM.
- Maintenance data analysis:
  - ➢Automatically compare data to previous test.
  - ➢Validation threshold.
  - ➢Automatic approval or warnings.

How to optimize battery management?

Drive Process Automation to Maximize Efficiency

- Notification:
  - Maintenance warnings.
  - Immediate action required.
  - Failed battery.
- Reporting:
  - Battery replacement reports.
  - Equipment usage reports.
- Telemetry:
  - Direct communication with smart equipment controller.
  - Automate Ohmic testing.

Implement health-based replacement program

Budget optimization:

- Warranty claims:
  - ➢ Automate process for identifying failed batteries under warranty.
  - ➢ Leverage historical readings extraction to file claim.
- Risk management:
  - ➢ Deferred CAPEX investment.
- Prioritize worst performing batteries for replacement.

Avoid downtime & improve network reliability

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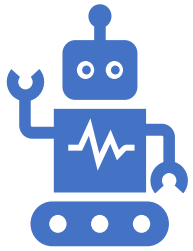
Practical Data

Battery Management Programs

Improving with Automation Optimization

- **Data-driven decisions**
- **Standardization** of maintenance practices
- Significant **time** and **cost savings**
- Real-time monitoring and analysis of **battery health**
- **Proactive** maintenance scheduling



Traditional vs Automated Maintenance Comparison

Data Gathering

PM Interval

Number of Sites

Health & Reliability

Replacement Strategies

Consistency

Cost

Key Evaluation Criteria

- Plan for Long Term Success with BMS.
- Test Multiple Solutions.
- Pick Best Solution for the Application.


Technical Capabilities


Cyber Security


Scalability


Systems Compatibility


Analytics


Vendor Support


Costs

BMS Implementation Steps

SYSTEM REQUIREMENTS

SYSTEM DESIGN

CONFIGURATION

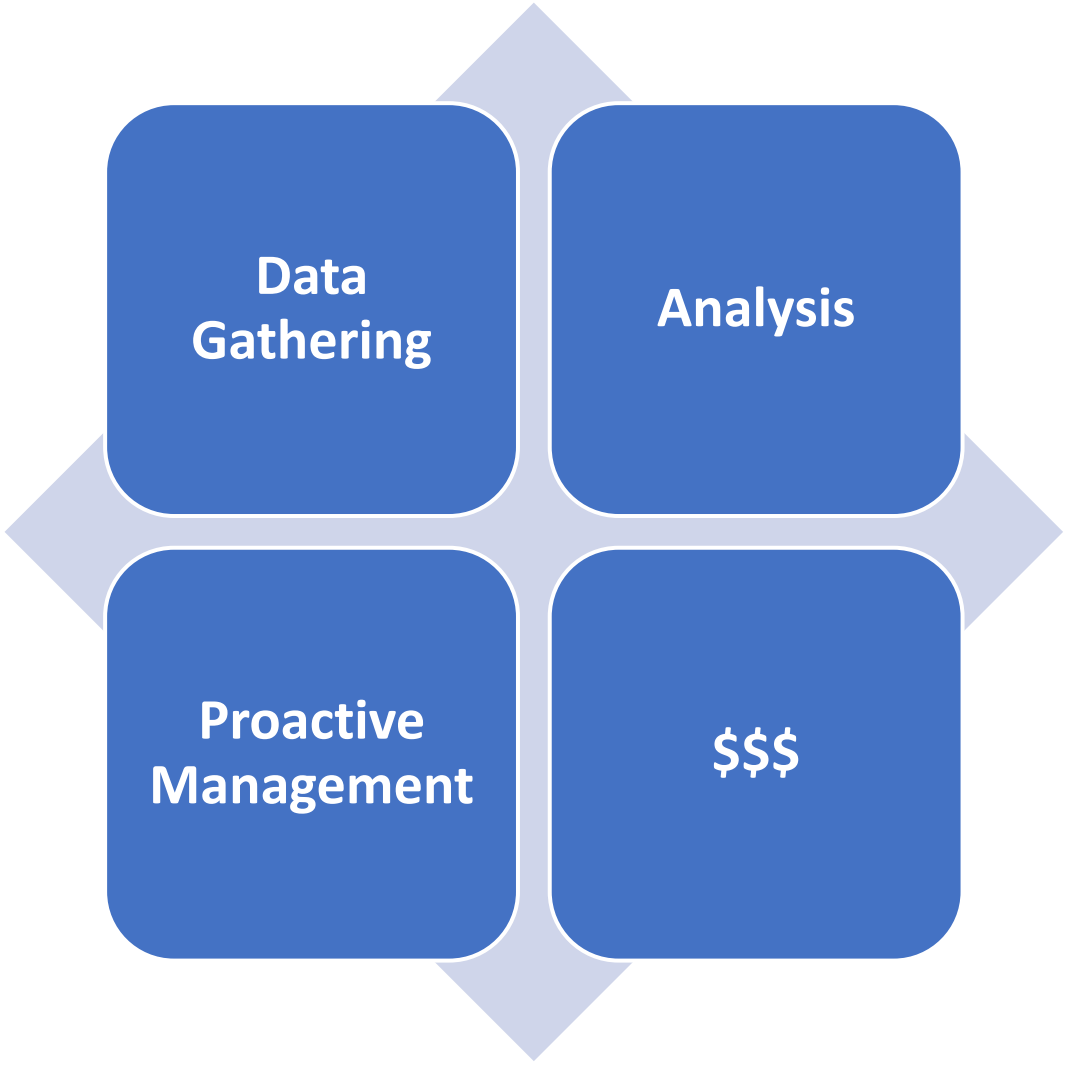
TRAINING

INSTALLATION

MAINTENANCE

Key Improvements

- Enhancing Proactive Replacement
- System Reliability



Batteries are the Backbone of Critical Systems