

# **Welcome to Session 106**

## ***The Lean Battery Room***

**Presented by:**

**Harold Vanasse**

**Dan Jones**

**Sponsored by:**



# The Lean Battery Room

# Seminar Outline

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- Lean Fundamentals
- Battery Needs
- Battery Room Basics
- Conclusion

# Lean is Coming!

**INDUSTRYWEEK** **CONNECTING MANUFACTURING'S LEADERS** **ADVERTISE | NE**

**IW** Keyword  **SEARCH**

**FORUMS |**

**LEADERSHIP & STRATEGY** **OPERATIONS** **ECONOMY & PUBLIC POLICY**

## The Goal of the Lean Supply Chain

Seven steps to building a lean supply chain  
By Mandyam M. Srinivasan, The University of Tennessee

**DC VELOCITY White Papers**

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### Strategies To Run a Lean Supply Chain

The blurring of the line between manufacturing and supply chain logistics provides the opportunity to move efficient manufacturing management concepts to supply chain management. One manufacturing concept stands out as most successful: the concept of lean. This white paper describes lean manufacturing and how it can be applied to supply chain management.

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Presented By: **EPICOR**

White Paper  
How principles of lean manufacturing transfer benefits to Operations

White Paper  
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**MATERIAL HANDLING** February 1, 2009

EQUIPMENT & APPLICATIONS | LIFT TRUCKS

### Lean fleets

If your lift truck fleet is typical, you probably have too many vehicles and bigger really need, say the experts. A fleet audit can help you find ways to trim the fat.

By Peter Bradley

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With peak season around the corner, a supervisor puts in a call for several lift truck rent arrive and are immediately put to use. After the busy season, the supervisor leaves the

## WORLD NEWS

### Lean Supply Chain Revolution

Two years ago, U.S. Navy personnel and their families assigned to the Arangi Navy base, home of the U.S.S. Kitty Hawk, were treated to a rare experience when Terry Fleming and his local Irish/American band, Innisfree, traveled to the base to entertain them on St. Patrick's Day. Fleming and the other few members of Innisfree were delighted and honored to be able to go to Japan and lift the spirits, if only for a few hours, of teacher and assistant director of the Orange County Symphony and Mike Tiffany, bass, a computer engineer. The band has been playing the tough and breath of California for the past 25 years. They have played at pubs, wakes, weddings, birthdays and on occasions where there was little cause for throwing a party.

Fleming says it was by coincidence the band got the opportunity to travel to Japan. Another band was unable to perform because of a scheduling conflict with a family member's wedding in south of Tokyo — left like home away from home, with its lush green rolling landscape and its multitude of cherry blossom trees. "Yes," Fleming says, "one was struck by the commitment and dedication of our men and women in uniform as they played their part in protecting and serving in an ever-challenging and hectic world."

A couple of the families even took time out from their busy schedule to attend the performance. For more information, contact the band.

White Paper Series:  
Lean Guiding Principles for the Supply Chain  
Principle 1: People Involvement

**PEOPLE INVOLVEMENT**  
PI

CI  
SRT  
CUSTOMER  
BIG  
S

**Ryder**  
EXECUTION IS EVERYTHING

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# Lean Battery Room → Lean DC

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- There is a lot of waste to be eliminated in the battery room itself.
- A badly run battery room causes waste in the whole DC.
- The goal of this presentation is to find that waste and propose solutions.

# Why...

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...hasn't this waste been identified?

- Hard to measure.
- Not seen as important.
- Lack of understanding.
- Fire fighting vs. long term solutions.
- Maintenance vs. operations perspective.

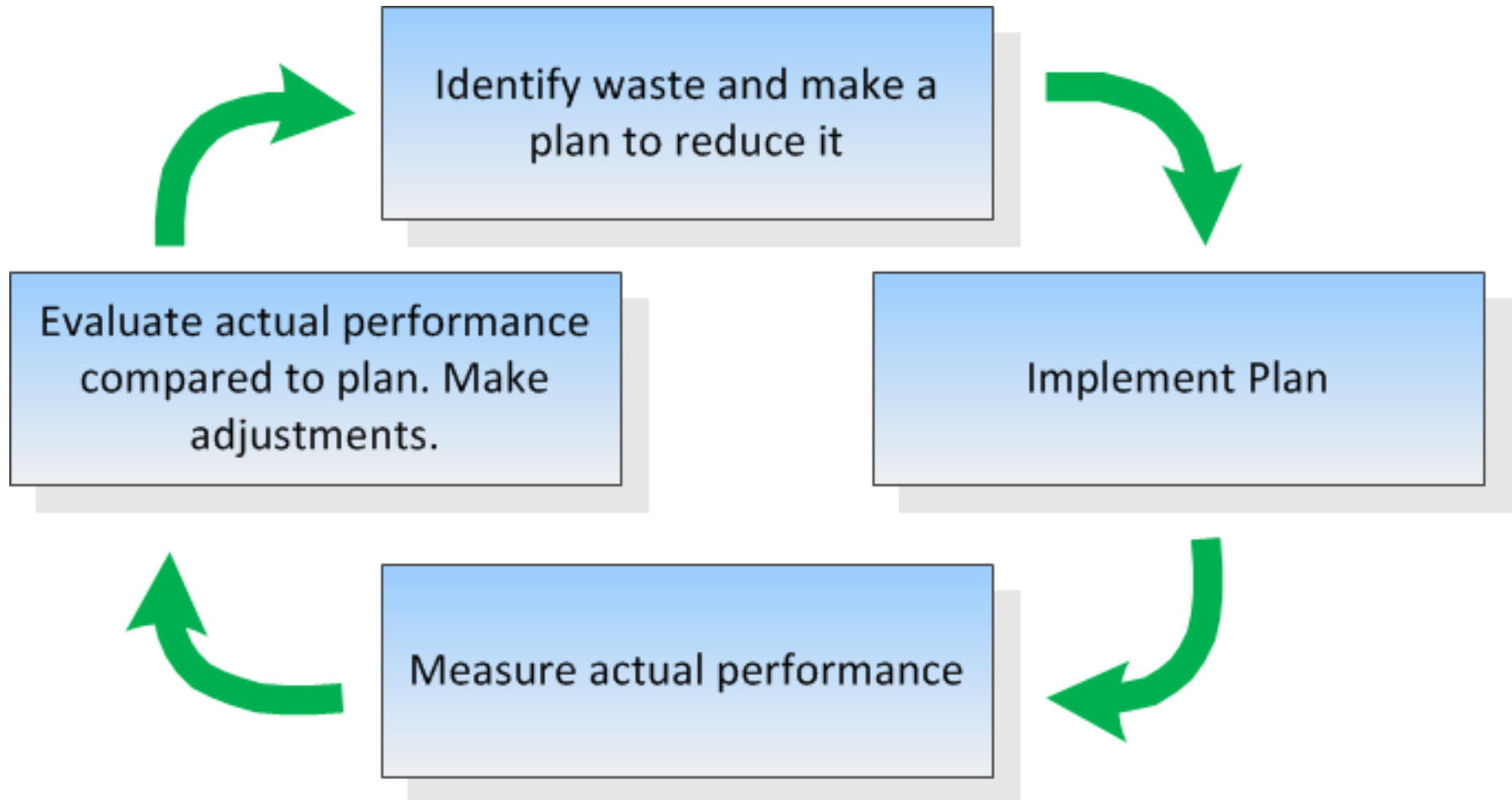
# What is Lean?

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- Lean is about reducing waste.
  - Six sigma is about reducing variability.
- You cannot change what you are not measuring!
- Feedback is required for continuous improvement.

# Basic Lean Steps

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# Identifying Waste

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- There are 8 traditional sources of waste in the Lean program.
- We have found that 6 of the 8 occur in the battery room.

# TIM P WOOD

- **T**ransportation
- **I**nventory
- **M**otion
- **P**eople
- **W**aiting
- **O**verproduction
- **O**verprocessing
- **D**efects



# Transportation Waste

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- Definition: Excess motion or movement between processes.
- Sources:
  - Battery changes.
  - Trips to the battery room
- Goal: Minimize number of battery changes.

# Inventory Waste

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- Definition: Excess material or assets.
  - More batteries and chargers than needed to get the job done.
- Sources: Battery and charger assets.
- Goal: Right-Size your fleet.
  - Get your work done with the minimal amount of batteries and chargers without affecting operation.

# Motion Waste

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- Definition: Excess movement of people who are performing an operation.
- Sources in the battery room:
  - Battery changing process
  - Battery watering process
- Goal:
  - Minimize time to change a battery
  - Minimize time and frequency of watering batteries

# People Waste

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- Definition: Under utilization of people.
  - It is not necessarily a reduction of people.
  - Using too high a skill level for a job.
- Sources in battery room:
  - Too many people watering and changing batteries.
  - Mechanics/electricians watering batteries.
- Goal: Right person and right number of people for the job.

# Waiting Waste

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- Definition: Time wasted while waiting for process to begin.
- Sources in the battery room:
  - Operators queuing for battery changes.
  - Waiting while battery is being watered.
- Goal: Manage bottlenecks in the battery room to eliminate queuing.

# Over-Production Waste

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- Definition: Creating and ordering more than necessary.
- Does not apply to the battery room.



# Over-Processing Waste

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- Definition: Adding more value than needed.
- Does not apply to the battery room.

# Defects Waste

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- Definition: Making errors in the product or service.
- Sources in the battery room:
  - Selecting the wrong battery
    - The wrong battery is the one that is not fully charged and cooled down.
  - Too little or too much watering.
- Goal:
  - Always pick the battery that is fully charged and cooled down.
  - Always water the battery to the appropriate level.

# Battery Needs

# What is the difference?

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- From the outside all batteries look the same.
- It is hard to tell a good one from a bad one.
- Unlike many things in a DC, batteries are chemical and not mechanical.

# Batteries are a Mystery

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- Where do people get their battery information:
  - Battery expert
  - Urban Legend
  - Old Wives' Tales
  - Bathroom wall
- Because there are so many source, let's review some care & feeding basics

# The Nature of a Battery

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- Batteries wear out over time and use.
  - Batteries degrade even when not being used.
  - Batteries have a set number of cycles.
- Like brakes & tires they wear out over time, but you can't see the wear.

# Battery “Care & Feeding”

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- Charging
- Discharging
- Cycling
- Watering
- Cables & Connectors
- Washing

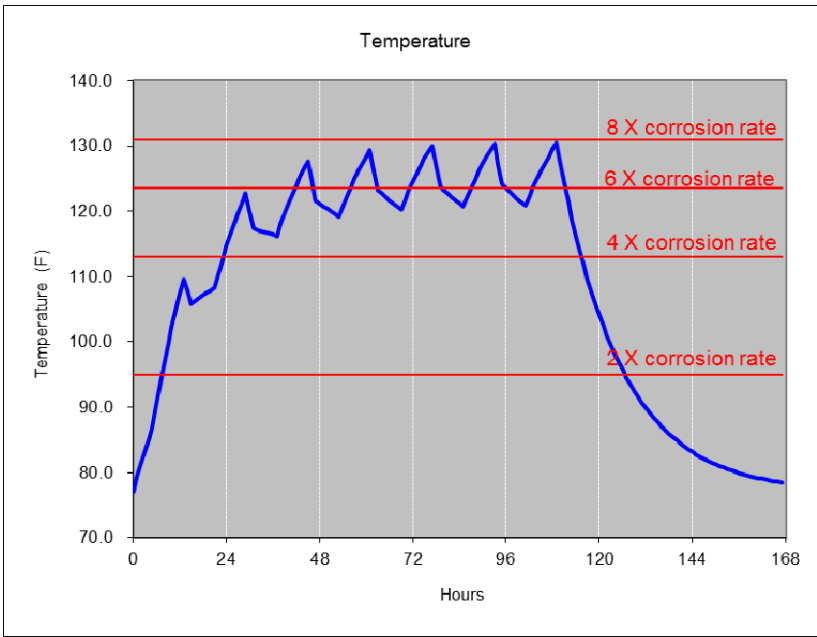
# Charging

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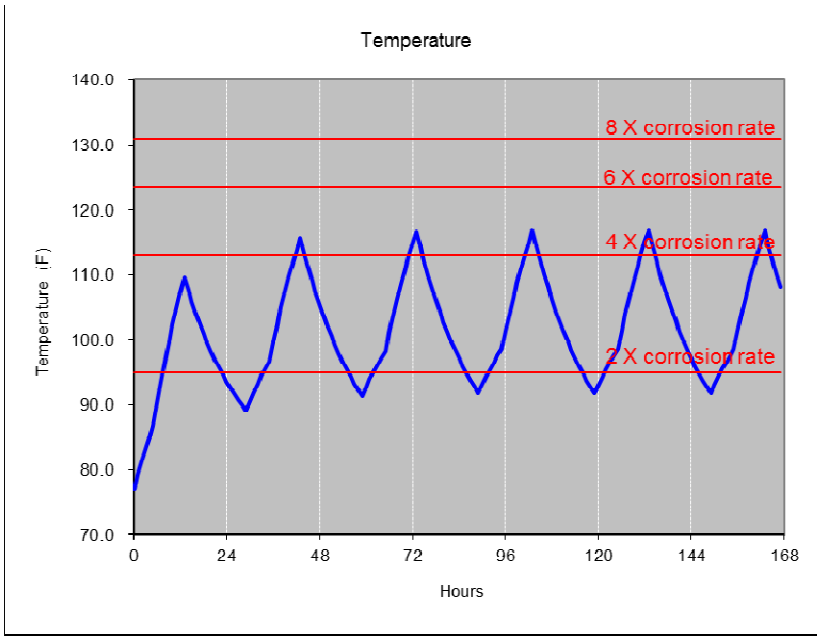
- Fully charge your battery to make sure that electrolyte is properly mixed.
- Never disconnect when charging.
  - Damages connectors.
  - Possible explosion hazard.
- Allow battery to cool down before using.
  - Heat shortens battery life.
  - Typical industry recommendation is a minimum of 8 hours.



# Battery Temperature



Not enough cool down



Proper cool down

# Discharge

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- Fully discharge your battery.
  - Partial discharges increase the number of cycles.
  - Decreased productivity; changing batteries is not moving material.
- Do not over-discharge your battery.
  - Permanent battery damage occurs.
- Lift lock-outs must be used and calibrated.

# Cycling

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- Under Cycling
  - Batteries corrode even when they are not being used.
  - Cycles are wasted.
- Over Cycling
  - No time to cool down.
  - Batteries corrode faster when they are hot.
  - Battery life is shortened and number of cycles is reduced.

# Watering

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- Not watering your battery:
  - Exposes the plates to air.
  - Exposed surfaces sulfate and lose capacity.
- Over-watering reduces capacity.
  - Battery loses acid.
  - 3% capacity loss for each boil-over.
- Use deionized or distilled water.
  - Dissolved minerals cause battery damage.

# Cables & Connectors

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- Repair broken cables.
  - Short circuits.
  - Fire and safety hazard.
- Repair broken connectors.
  - Intermittent contact is hard on chargers.
  - Arcing is dangerous.

# Washing

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- Minimizes short circuits tracking across the surface of the battery.
- Hidden energy loss.
- Minimizes tray corrosion.

# Battery “Care & Feeding”

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- Implementing these practices will maximize battery performance and life.
  - Charging
  - Discharging
  - Cycling
  - Watering
  - Cables & Connectors
  - Washing

# Battery Room Basics





# Where To Focus?

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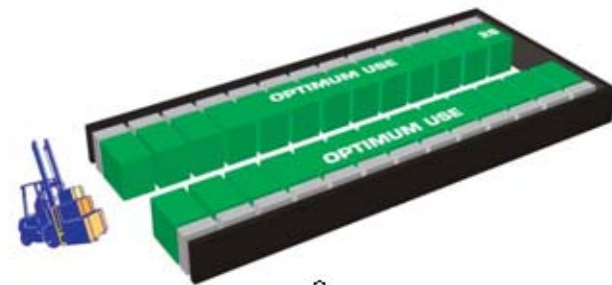
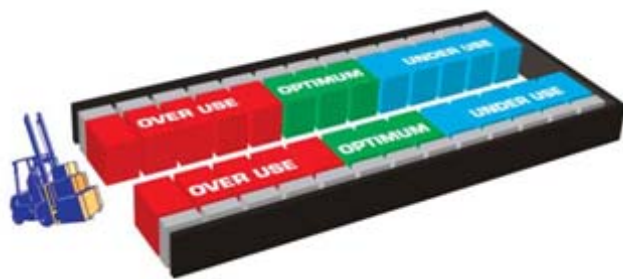
## The Big Three Impacts:

1. Rotation
2. Right Sizing
3. Battery Watering

# 1: Rotation

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- What is it?
- Why is it important?



# Fast Selections

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Closest

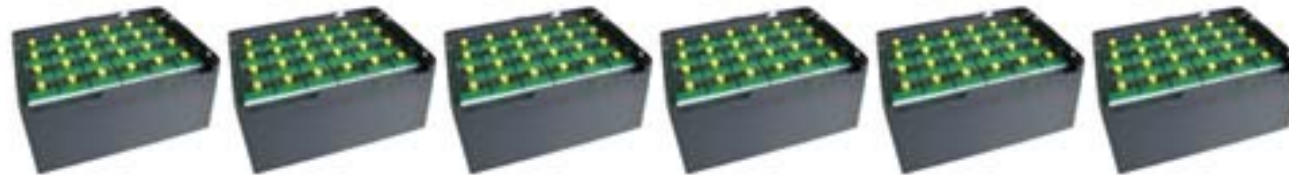


# Fewer Selections

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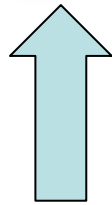


Newest



# Correct Selections

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Coollest



# Conflicting Demands

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- Pick closest battery to make fast change.
- Pick newest battery and hope to get long run-time.
- Picking coolest battery is best for maximum run time and longest life.

# The Challenge

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- Picking the coolest battery – quickly – every time.
  - Run time will be maximized over the long term.
  - Battery damage will be minimized.
- Getting your operators to do this.
  - Make picking the right battery easy.
  - Measure performance for accountability.

# Impact of Battery Rotation

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- A study done on introduction of good battery rotation practices.
  - Data collected 3 months before and 3 months after proper battery rotation procedure introduced.
- Average battery run-time increased from 6h 30m to 6h 57m.



# More Than Just Run Time

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- Allowing batteries to cool down is extremely important for battery life.
- Properly rotated batteries will have better cool down time.
- This will give you longer life.

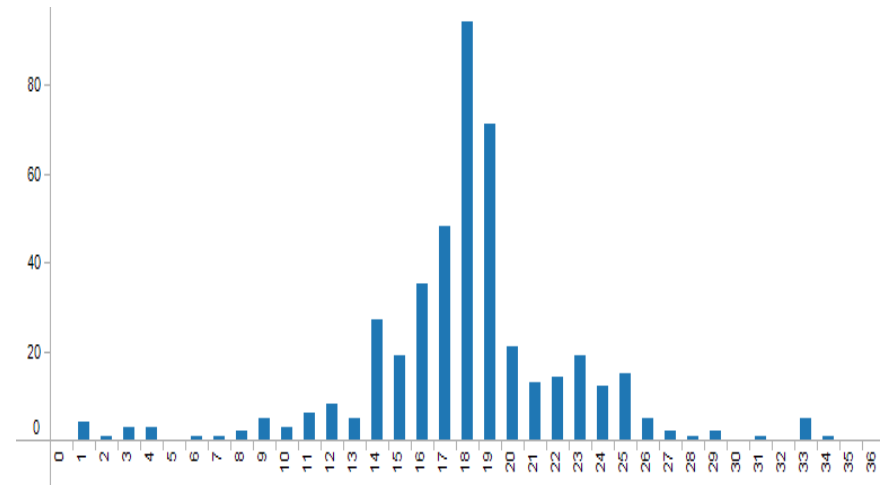
# Cool Down Time

## Without Rotation



Less than 8-hours of cool down occurs 44% of the time

## Proper Rotation



Less than 8-hours of cool down occurs 3% of the time

# 2: Right Sizing

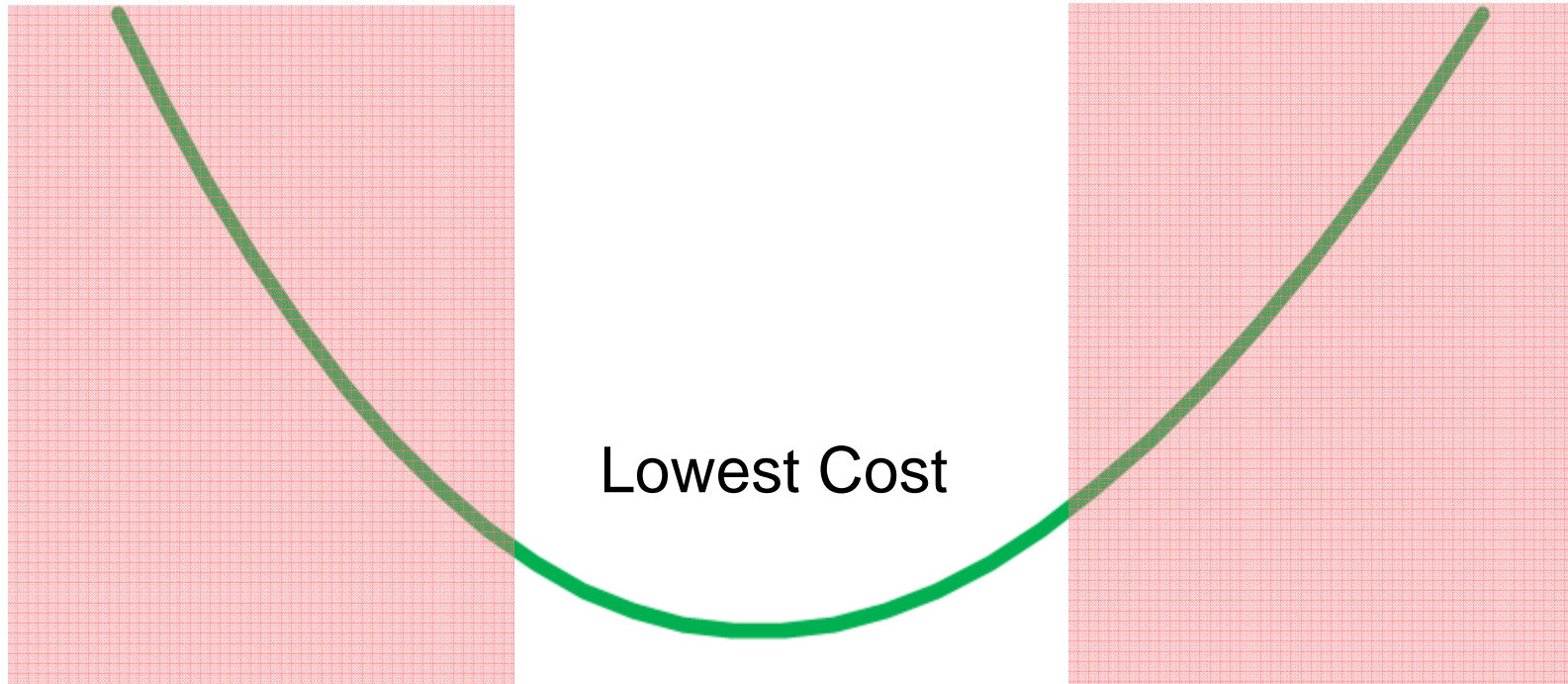
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- What is it?
- Why is it important?

# Battery Fleet Size

Too Few

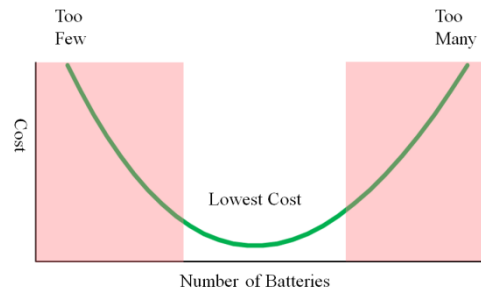
Too Many



Number of Batteries

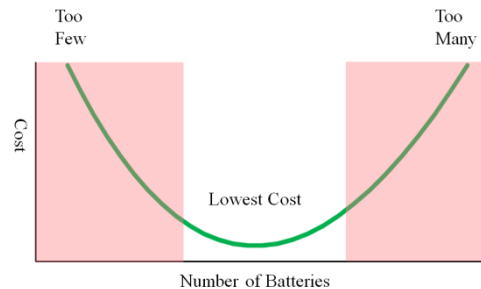
# Cost of Not Right-Sizing

- Battery damage
- Short battery life
- Low battery availability
- Disruption to operations



# Cost of Not Right-Sizing

- Battery damage
- Short battery life
- Low battery availability
- Disruption to operations



- Too much money spent on batteries.
- Wasted space
- Battery degradation

# Challenges for Right-Sizing

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- Lack of objective information.
- How much is “right”?
- The right answer changes over time.
  - Batteries age over time
  - Business grows/shrinks over time
  - Busy seasons
  - Equipment changes

# Methods for Right-Sizing

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- Perform a power study combined with an aging spreadsheet.
- Listen to operators.
- Industry “standard” ratios.
- Lean method.



# Power Study

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- Pros:
  - No investment needed.
  - Objective measurement.
- Cons:
  - Assumptions can be faulty.
  - Judgment required.
  - Aging spreadsheets become invalid over time or when conditions change.
  - No feedback.

# Listen to Operators

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- Pros:
  - No investment and no expense.
  - Operators are in contact with what is really happening.
- Cons:
  - Feedback can be unreliable and subjective.
  - Difficult to take action on because it is non-structured.

# Industry “Standard” Ratios

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- Pros:
  - Simplest to implement.
- Cons:
  - Assumes that all facilities run the same way.
  - Does not account for changes over time.

# Lean Method

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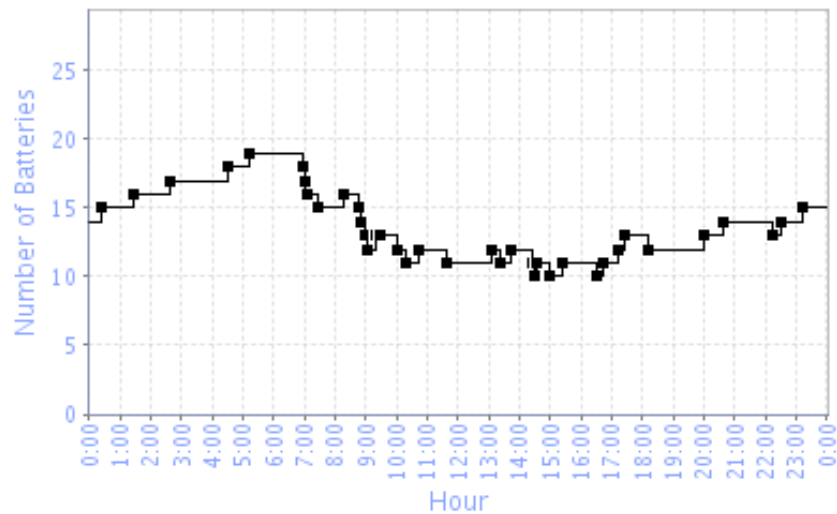
- Pros:
  - Objective measurements.
  - Actual performance measured.
  - Constant feedback & adjustment.
- Cons:
  - Equipment required.

# Lean Method

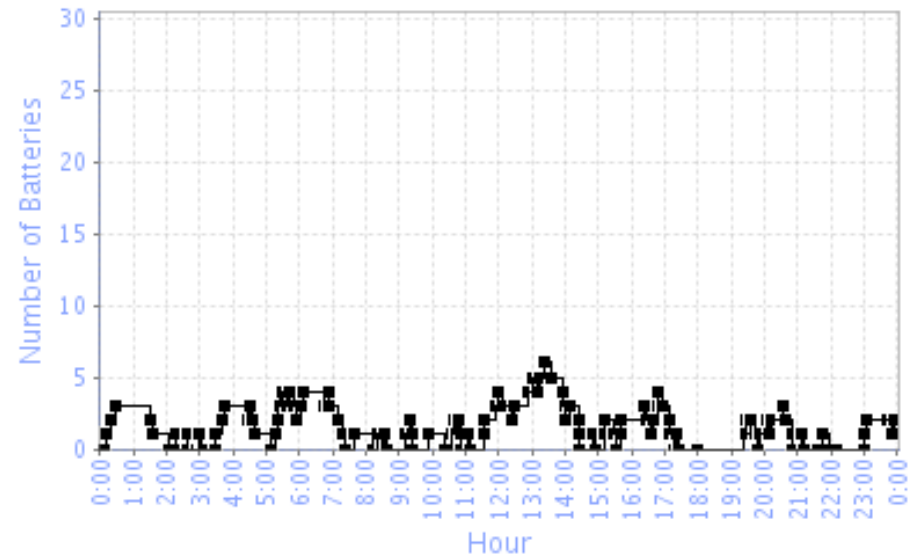
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- What Do You Measure?
  - Battery availability at any given time.
  - Cool down time.
  - Battery cycles per week.

# Battery Availability



More batteries than needed



Running out of batteries

# 3: Battery Watering

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Is actually two steps:

- Figuring out which battery needs water.
- Actually watering the battery.

# Identify Which Batteries Need Water

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## Three Methods:

- Inspect every battery every week.
  - Slow
- Water batteries by schedule.
  - Complicated
- Use a electrolyte level indicator.
  - Fastest



# Methods of Watering

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- Manually – hose or jug.
  - 18 minutes per battery.
- Watering Gun .
  - 10 Minutes per battery.
- Single Point Watering System.
  - 15 seconds to 4 minutes per battery.














For a 36 Volt Battery

# Ideal Lean Battery Room

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- Always pick the coolest battery that has finished charging.
- Change batteries quickly.
- Have the right quantity of batteries.
- Only water batteries that need it.
- Water quickly and accurately every time.
- Keep batteries clean.
- Keep cables and connectors in good condition.

# Lean Checklist

Waste	Rotation	Right Sizing	Watering
Transportation			
Inventory			
Motion			
People			
Waiting			
Over Production			
Over Processing			
Defects			



## ***For More Information:***

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