Inventory Optimization vs. Operational Reliability: Finding the Balance

Strategic Supply Chain Management for Utilities
Marriott West Palm Beach, FL

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TVA
ScotMadden
Management Consultants
This Morning’s Agenda

1. Key Definitions & Concepts
2. An Industry View
3. A Company View - TVA
4. A Call to Action
1. Key Definitions & Concepts

◆ Q: What is “Inventory?”
◆ A: It Depends where you sit

<table>
<thead>
<tr>
<th>What’s on the Books</th>
<th>What’s in the Warehouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>FERC Form 1 - Account 154 – Plant Materials &amp; Supplies</td>
<td>Any materials &amp; supplies that are received, putaway, and issued from the warehouse</td>
</tr>
<tr>
<td>“Materials purchased primarily for use in the utility business for construction, operation, and maintenance purposes”</td>
<td>FERC Account 154 materials plus any non-costed, capitalized materials (“pre-cap materials”)</td>
</tr>
</tbody>
</table>

Accountant’s View

Materialsman’s View
1. Key Definitions & Concepts (Cont’d)

Q: What is “Inventory Optimization?”
A: The least amount of inventory needed to achieve a desired level of service

Requires balancing the following components:

- Operating Costs
  - Warehouse Costs
  - Purchasing Costs
  - Stock Control

- Customer Service
  - Material Availability

- Inventory Costs
  - Cash Tied up in Inventory
1. Key Definitions & Concepts (Cont’d)

◆ The catch – Achieving high levels of service requires more inventory – or improved planning

- Moving from 95% to 99% requires 40% more inventory

<table>
<thead>
<tr>
<th>Service Level</th>
<th>Safety Factor Multiplier</th>
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</thead>
<tbody>
<tr>
<td>70%</td>
<td>.524</td>
</tr>
<tr>
<td>75%</td>
<td>.674</td>
</tr>
<tr>
<td>80%</td>
<td>.842</td>
</tr>
<tr>
<td>85%</td>
<td>1.036</td>
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<tr>
<td>90%</td>
<td>1.282</td>
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<tr>
<td>95%</td>
<td>1.645</td>
</tr>
<tr>
<td>97.5%</td>
<td>1.960</td>
</tr>
<tr>
<td>99%</td>
<td>2.326</td>
</tr>
<tr>
<td>99.9%</td>
<td>3.291</td>
</tr>
</tbody>
</table>
1. Key Definitions & Concepts (Cont’d)

◆ A Performance Measurement Framework

Inventory and Operating Costs

- Inventory value
- Inventory carrying costs
  - Financing costs
  - Insurance
  - Taxes
  - Commodity devaluation
  - Damage / repair
  - Obsolescence
  - Shrinkage
- Warehouse facilities
- Warehouse labor

Operating Performance

- Need Date Lead Time
- % Orders After Cut Off
- Inventory turnover
- Days inventory
- Inventory count accuracy rates
- Return rates

Efficiency & Effectiveness Measures

Balancing Act

Customer Service

- % Material availability
- % Stock outs
- Work disruptions due to material availability
- Plant capacity factors
- SAIDI / SAIFI
- Customer satisfaction score
2. An Industry View

- Based upon results of the ScottMadden Utility Materials Management Benchmarking Study
- Launched at the 2007 Platt’s Strategic Supply Chain Management for Utilities conference

— Business unit level reports distributed in December 2007
  - T&D
  - Fossil Generation
  - Nuclear Generation
  - Gas Turbine Generation
  - Hydro Generation
2. An Industry View (Cont’d)

**Utility Materials Management Benchmarking Consortium**

- 15 leading utilities worked together to establish the Utility Materials Management Benchmarking Consortium (UMMBC)
- The purpose was to share detailed information and improve materials management operations within the participating companies
- The member companies have combined annual revenues of $107.5 billion and generated over 253,800 MWs of electricity across North America
- For a list of member companies, or to join the consortium, please contact the authors

**Number of Participating Warehouses**

Total = 256

- **Fossil Generation**: 138
- **Nuclear Generation**: 42
- **Gas Turbine Generation**: 44
- **Hydro Generation**: 17
- **Electric and Gas T&D**: 15

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TVA | ScottMadden
2. An Industry View – Inventory Costs

◆ Let’s look at key industry performance metrics

Inventory and Operating Costs
- Inventory value
- Inventory carrying costs
  - Financing costs
  - Insurance
  - Taxes
  - Commodity devaluation
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2. An Industry View – Inventory Value

- Company inventory values have been rising for the past five years – and are accelerating.

Source: FERC Form 1, Account 154: Total Plant Materials and Operating Supplies
This is largely driven by growth in T&D and nuclear generation inventories.

2. An Industry View – Inventory Value

- The nature of your asset base impacts your inventory levels
- Nuclear plants have 4 times more inventory per generation MW than fossil plants

![Graph showing median $ value of total on-site materials per MW of generation, 2006.](Source: ScottMadden 2007 Utility Materials Management Benchmarking Report (December 2007))
What’s driving this growth?

- Growth in underlying asset base
  - Plant additions, expansions and upgrades in generation
  - Environmental upgrades (Coal plants with scrubbers have 4.5 times more inventory than those without)
  - New / upgraded T&D infrastructure
- Rising cost of materials

Prognosis:

- Company inventory levels will continue to grow by 6% to 8% per annum over the next 5 to 10 years - barring a major recession
2. An Industry View – Carrying Cost

Carrying cost is the cost associated with holding inventory.

It consists of such costs as:

- Financing costs
- Insurance
- Property Taxes
- Commodity devaluation
- Damage / repair
- Obsolescence
- Shrinkage
- Facility maintenance
- Warehouse labor

The average annual inventory carrying cost in the U.S. is 21.8% of the inventory balance.¹

¹ IOMA, Supplier Selection & Management Report, February 2005, p.2
Carrying costs within the utility industry are generally lower but still significant (Examples below)

- Large Northeast Utility . . . 14.4% (T&D)
- Large Southeast Utility . . . 13.2%
- Large Southern Utility . . . 12.0% (Gen)
- Large Southern Utility . . . 13.4%

If we assume a conservative inventory carrying cost of 12% across the industry, then holding FERC 154 inventory costs U.S. ratepayers more than $1.4 Billion in 2006

Reducing inventory frees up working capital and reduces operating expenses
2. An Industry View – Operating Performance

◆ Now, let’s look at efficiency measures

**Inventory and Operating Costs**
- Inventory value
- Inventory carrying costs
  - Financing costs
  - Insurance
  - Taxes
  - Commodity devaluation
  - Damage / repair
  - Obsolescence
  - Shrinkage
  - Warehouse facilities
  - Warehouse labor

**Balancing Act**

**Operating Performance**
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2. An Industry View – Inventory Turnover

- Inventory turnover rates at U.S. manufacturing plants range from 2.0 to 14.0.
- Turnover rates at utilities are considerably lower and vary by business unit.

2. **An Industry View – Days Inventory**

- Most manufacturing companies hold from 30 to 60 days of *working* inventory.
- Utilities hold from 5 months to 10 years worth of *MRO* inventory.

**Median Days Inventory – All On-site Materials, 2006**

- Fossil Generation: 885 Days
- Gas Turbine Generation: 913 Days
- Hydro Generation: 3,865 Days
- Nuclear Generation: 995 Days
- Transmission & Dist.: 164 Days

2. An Industry View – Slow Inventory

- A significant % of utility inventory is “slow” or “no” moving inventory
- Could be “critical spares.” Could be “junk”


Median $ Value of Inventory with No Issues Over Past 5 Years

- Fossil Generation: $2,279,941
- Gas Turbine Generation: $1,425,094
- Hydro Generation: $54,208
- Nuclear Generation: $19,023,401
- Transmission & Dist.: $523,176

2. An Industry View – Inventory Accuracy

- Physical count accuracy in U.S. manufacturing plants averages 99.0 to 99.999%
- Median count accuracy rates in U.S. utilities range from 93% to 99%

2. An Industry View – Return Rates

- Returns = issued material that is not used and subsequently returned to the warehouse
- Returned material affects inventory levels and productivity

**Median Value of Material Returns as % of Material Issues (by $ Value)**

- Fossil Generation: 18%
- Gas Turbine Generation: 3%
- Hydro Generation: 24%
- Nuclear Generation: 28%
- Transmission & Dist.: 14%

2. An Industry View – Return Rates

Higher return rates are associated with higher inventory levels

Correlation between Material Returns as % of Issues and $ Value of Over-Max Inventory

Correlation Score = + 0.3325

2. An Industry View – Customer Service

◆ Finally, let’s look at customer service levels

Inventory and Operating Costs
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Efficiency & Effectiveness Measures

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2. An Industry View – Service Levels

Unfortunately, direct service level data was not collected as part of the 2007 ScottMadden Utility Materials Management Benchmarking Study. (Maybe this year) Candidates include:

- Fill rates (Line fill rate; Work order fill rate)
- “Perfect Order” Rate
- Work delays due to materials shortage

In lieu of these we examined the following macro indicators of operating performance:

- For Generation: Plant Capacity Factor %
- For T&D: SAIFI and SAIDI
2. An Industry View – Service Levels

- Additional days of fossil inventory on hand are associated with “lower” levels of plant operating performance
2. An Industry View – Service Levels

- Similarly, T&D inventory levels are also associated with higher levels of T&D system failure as measured by SAIFI scores.
And the same is true with regard to SAIDI scores


“SAIDI” = System Average Interruption Duration Index
Inventory $ values are growing

There is a significant financial cost associated with holding this inventory

All indications are that most utilities are holding more inventory than necessary

Higher levels of inventory are not justified by performance levels requirements

Collaborative demand planning is key to lowering inventory levels

We can do better
3. Case Study – How One Leader Manages It

Tennessee Valley Authority

Lessons Learned In Controlling Inventory Levels
3. About TVA - Vision

Tennessee Valley Authority

“A corporation clothed with the power of government but possessed of the flexibility and initiative of a private enterprise.”

-Franklin Roosevelt
3. About TVA – The TVA System

- TVA Generating Plants
- Transmission System
- Directly Served Industries
- Distributor Customers
- Interconnection Points
- Residential, Commercial, Industrial
3. About TVA—Generating Facilities

- 11 fossil plants (59 units)
- 3 nuclear plants (6 units)
- 29 hydro plants (109 units)
- 8 combustion turbine plants (83 units)
- 1 pumped storage station
- 17,000 miles of transmission line
- Watts Bar Nuclear Unit 2 Construction Site
3. About TVA – Procurement

◆ Our Vision:
  — Reduce TVA's cost of power and support other operations by achieving world class supply chain management processes which focus on centralized sourcing with decentralized execution

◆ Fast Facts:
  — Annual spend of $2.45B
  — Manage $358M of TVA’s working capital / inventory
  — Approximately 350 employees
  — 80% of spend is with the top 80 suppliers
  — Internal and external customers
3. About TVA – A Fleet-Wide Approach

◆ Materials Management and Contracting are managed on a fleet-wide basis

◆ Indus PassPort is current supply chain system and it enabled a fleet-wide approach for contracting and materials management

◆ TVA is in process of transitioning to IBM Maximo which will have integration of Supply Chain with Work Management and will enable better automation and communication
4. Inventory Management - Perspective

◆ A Financial Perspective: Our goal to manage cash flow and preserve capital dollars

◆ Effective Planning, Contracting and Inventory Management offers an opportunity to reduce TVA’s cash flow and required capital dollars

◆ Contracting and Inventory management risks have to be balanced with operation risks

◆ Team approach with customers to maximize opportunities and balance risks versus raising inventory levels
4. Inventory Management - Approach

◆ Q: Where is inventory best managed?
A: Before it reaches the warehouse

◆ Proper Planning and Identification of Needs
  — Just In Time Contracting
  — Utilization of Existing Material – “No Buy is the Best Buy”

◆ Strategic contracting
  — Supplier Managed Inventory (SMI)
  — Supplier buybacks
  — Supplier stocking
4. Inventory Management – Focus Points

◆ Our primary focus areas are:
  — Returns to Stock - Return of unused material to inventory
  — Contingency Buys – “Just in Case” material
  — New Stock Additions
  — Changes to Inventory “Min/Max” levels

◆ Focusing on Returns to Stock and Contingency Buys offer the greatest potential for managing Inventory Growth
4. Inventory Management – Organization

- Dedicated Inventory Specialist positions at larger plants or shared at smaller ones

- Responsibilities include:
  - Review Closed/Cancelled Work Orders for Effect on Inventory
  - Aggressive Review of Reorder Rules
  - Material Identification
  - Transfers From Other Locations
  - Cancel Open Orders and Reorder Notices to Prevent New Buys
  - Lower Target Maximums to buy Less Material
  - Identify Description Only Items to Determine if Already In Inventory
  - Utilize Fleet Inventory – Avoid buy
4. Inventory Management – Organization

◆ Use of Site Inventory Review Committee (SIRC)

◆ Provides a platform for Plant Management to review activities that have potential to impact plant inventory.
  — SIRCs review actions that affect inventory > $2000
  — Meetings are usually less than 1 hour and occur weekly, bi-weekly, or monthly depending on the site

◆ Site Plant Managers have responsibility for SIRC but may delegate

◆ Procurement provides agenda items for review and disposition
  — Includes New Items, Target Maximum increases, Reorder Quantities, for items > $2000 per transaction
  — Also includes reviews of slow moving inventory for Write-off
4. Inventory Management – SIRCs

OUTCOME:
COLLABORATIVE APPROACH TO BALANCE INVENTORY DECISIONS WITH PLANT OPERATIONS.
4. Inventory Management – Strategies

**Shared Inventory**
- Inventory is shared across sites using a Fleet Wide Approach
- A review of Fossil and Nuclear items over $25,000 in value revealed only a few items that were stocked in dual locations

**Supplier Managed Inventory (SMI)/Supplier Buybacks**
- Used primarily at Fossil sites for high turn/low dollar materials
- All leverage contracts have buy-back provisions that enable TVA to sell back unused material for price paid

**Surplus Material Redeployment**
- Cancelled Hartsville nuclear site is centralized location for surplus material
- “Best Buy is No Buy” – Hartsville Material is visible in PassPort to all sites
- FY07 Surplus Material Redeployment - $14M
Information Technology Support

◆ Current inventory system (Indus Passport) provides limited inventory optimization capabilities
  — EOQ model is used for high-volume, consistent use materials (only 5% of inventory $ value)
◆ All other replenishment estimates are developed based upon the personal experience and judgment of the material analysts in conjunction with the SIRCs
4. Inventory Management – Results

- Inventory levels are trending downward for both Generation and T&D (PSO). They are trending slightly upward for Nuclear Generation — This despite increases in capital spending and new construction

- Material availability performance has been maintained or improved

- $27M in Savings in FY07

- $68M Savings over last four years
“It’s not a buyer’s market, not a seller’s market, but rather a planner’s market”

Planning, Planning, Planning, Planning!
5. Wrap Up – Four Critical Actions

1. Work in collaboration with operations and maintenance to improve demand forecasting
   - Extend work windows for material planning
   - Eliminate “just in case” planning mentality
   - Eliminate floating “Need dates”
   - Aggressively reduce material returns
   - Search out and eliminate incentives to increase inventory
5. **Wrap Up – Four Critical Actions (Cont’d)**

2. **Use proven inventory optimization techniques**
   - Software tools to model usage patterns and optimize replenishment
   - Examine required service levels for each SKU (once size does not fit all)
   - Train users in optimization techniques

3. **Establish new incentives to reduce inventory**
   - Get management and staff thinking about inventory

4. **Measure performance**
   - Fill rates
   - Impact on operations and maintenance
Thank You

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