# Industrial Steam Efficiency:
# Checklist for Getting Management Approval

***Note: These slides are best used for individual reading and reference, not for making presentations***

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# Checklist Contents

**PURPOSE:** This document presents the elements for any discussion that promotes industrial steam system improvements. "Energy efficiency" actually provides *control over thermal resources*, which is a true benefit to manufacturers that are struggling to compete in today's product markets.



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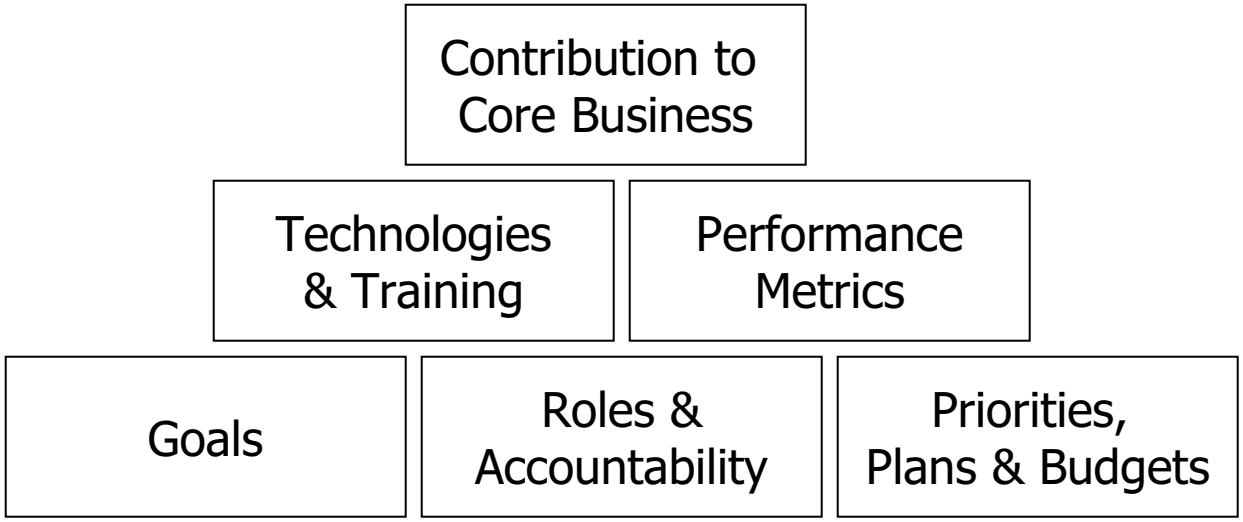
# What *is* Industrial Steam Efficiency?

**Energy Efficiency** = **Thermal Control** = **Process Reliability** = **Improved Business Performance**




***"You can't manage what you don't measure"***

***Energy efficiency is woven into every-day facility activities.***

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# Management Objections

**THE NEXT TEN SLIDES:**

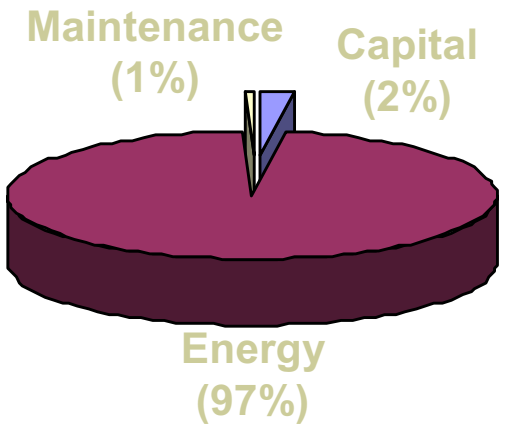
Manufacturers are in the business of making products, not being energy efficient.

"Energy efficiency" is widely misunderstood. That's why there are so many objections to it.

Use the next ten slides to demonstrate how energy efficiency contributes to corporate and plant goals.

## Management's Objections (1 of 10)

# "We don't have the money for energy efficiency projects." (1 of 2)




**Life-Cycle Boiler Costs**

- They're right! They're spending all their money on fuel.
- They can pursue quick payback efficiency projects of 120, 90, 60 days or less (See Slide 9).
- After the payback period, they will have recouped the cost of the improvement project. The ongoing savings are NEW MONEY.

☑ Challenge management to start with low-risk improvements such as combustion improvements, changes in operating procedure, or other quick return, non-capital items.

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## Management's Objections (2 of 10)

# "We don't have the money for energy efficiency projects." (2 of 2)

- The plant's budget is probably set in stone, with no more money available.
- But look at other budget line items. What's the timing?
  - Insurance: two lump-sum payments, May and October
  - Legal & Audit: lump sum due in June
- They can borrow against either of these accounts?
  - Pay for a 30- or 60-day payback project.
  - Energy savings pay back the "loaned" amount.
  - Savings after payback are **new cash flows**.

☑ Challenge management to borrow from within the budget, pay back within 2-3 months.

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## Management's Objections (3 of 10)

# "We don't have the time."

- That's because they're too busy putting out fires and playing catch-up on overtime shifts.
- Select projects that can be hired out to a consultant, vendor (Energy Performance Contractor), or a government or utility assistance program.
- Some states enjoy the availability of low- or no-cost troubleshooting assistance from state energy offices or university-based services. Consult the searchable, online database of **National Inventory of Manufacturing Assistance Programs** at www.oit.doe.gov/bestpractices/nimap.

☑ Take advantage of no- and low-cost assistance. Near term projects can be handled by a contractor. Over the long term, *energy management procedures* will (1) shift labor from reactive to proactive duties, and (2) reduce the frequency of fire drills, giving staff more time to monitor and control.

Near term = less than 12 months
Longer term = over 12 months

## Management's Objections (4 of 10)

# "We prefer to invest in growth, not savings."

- Energy efficiency activities recapture energy lost to leaks, radiant heat losses, dumped condensate, etc.
  - Grow thermal capacity without adding new assets
  - Extra capacity = extra output = more revenue
- Facilitate growth by providing a reliable utilities platform:
  - Energy efficiency = control = reliability = ability to fill orders faster = ability to fill more orders = growth.
- More end-product manufacturers are demanding environmentally-friendly supply inputs. Use plant efficiency to qualify for entry into these growing markets (See Slide 27).

☑ Demonstrate energy efficiency's potential to *grow revenues*.

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## Management's Objections (5 of 10)

# "Energy projects interrupt our process."

| Opportunities* | Pct. of Steam Load Avoided | Payback (Years) |
|---|---|---|
| • Combustion improvements | 1.50% | 0.92 |
| • Steam & condensate piping improvements | 0.95% | 0.83 |
| • Steam pressure reduction (not all plants) | 0.63% | 0.21 |
| • Heat recovery projects | 2.58% | 1.13 |
| • Changes to plant operating procedures | 2.66% | 1.29 |
| • Steam & fuel metering and monitoring | 0.28% | 1.39 |
| • Water management | 0.26% | 1.74 |
| • Miscellaneous non-capital projects | 0.89% | 1.72 |
| • Building space & domestic water heating | 1.07% | 2.34 |
| • Insulation improvements | 0.68% | 2.39 |
| • Boiler plant capital improvements | 1.65% | 4.44 |

* From summary of 66 boiler plant audits conducted by Enbridge Gas Distribution, Toronto, Canada, 1997-2002.

☑ The first 10-12 percent of steam savings come from well-proven, everyday techniques. Risk to production is minimal.

## Management's Objections (6 of 10)

# "I'm held accountable for production, not efficiency."

**Measuring, monitoring, and verification duties (MMV):**
"You can't manage what you don't measure."

- MMV activities detect most anomalies before they become big problems.
- Give the operator greater confidence in the plant's thermal balance. Increase the ability to extend production runs or add new process lines.
- Reduce reserve margins. Apply that extra capacity to productive uses.

☑ Energy efficiency = control = reliability = ability to meet and expand production targets.

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## Management's Objections (7 of 10)

# "I'd rather achieve efficiency by securing fuel at the lowest price."

- Low fuel prices may bring on complacency– there's less incentive to improve the consumption side of the expenditure equation (See Slide 16).
- Non-energy benefits are lost. Without a focus on consumption improvement, opportunities are lost to address related issues such as raw material waste, plant safety, idle resource costs, and improved capacity utilization.
- Exposure to energy market volatility is increased. With less incentive to reduce consumption, the manager is in a more vulnerable position should fuel prices spike upward.

☑ Energy expense is a function of price AND volume purchased. Also, energy-efficient practices make non-energy savings available.

## Management's Objections (8 of 10)

# "We're already as efficient as we can be."

- Sure, they may be 100% in using the best 20-year-old technologies and practices. Are they aware of energy management innovations since then? Are their energy-to-product ratios flat, or rising over time?

- Emissions compliance and workplace safety regulations also keep evolving. Energy management training also touches on these agendas. Plants that don't keep up with these compliance duties face a greater chance of fines or worse– the threat of life or property casualties.

- Give the plant manager a few BestPractices Steam **case studies**. If they appreciate software, give them a copy of the **Steam System Assessment Tool** (Everything is on the *Steam CD*, free from the DOE Clearinghouse: (800) 862-2086)

☑ Be sure that plant managers are aware of the wider range of energy efficiency practices and impacts.

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## Management's Objections (9 of 10)

# "Do nothing costs nothing."

Price of "doing nothing" can be very high. It includes:

- Revenues lost to downtime.
  Why? Energy efficiency = process control = reliability = greater output
- Unrealized revenues from extra capacity.
  Why? Energy efficiency = control = reduced leaks and losses = greater application of thermal resources = additional output = more revenue
- Higher fuel and utility expenses.
  Need to buy fuel to feed those leaks and thermal losses.
- Higher idle resource costs.
  Downtime? With idle machines, plants still incur labor, overhead, and interest costs.
- Greater exposure to safety and emissions penalties.
  Improved training and maintenance not only reduces energy use, it reduces compliance risks. Also, safer plants can reduce hazard insurance costs.

☑ Be sure that plant managers are aware of the wider range of energy efficiency practices and impacts.

## Management's Objections (10 of 10)

# "We need to cut the fat."

Be careful what you cut… it may be muscle!

**Energy Efficiency = Thermal Control = Process Reliability = Improved Business Performance**

Think twice about cutting anything that gives you the ability to:

- Reduce expenses
- Generate revenue
- Control risk

☑ Management needs to know how the central plant contributes to business goals.

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# Expense Savings

**THE NEXT SEVEN SLIDES:**

Most people equate “energy efficiency” with fuel bill savings.
It’s more than that.

Energy management activities can impact many line items on a plant’s operating budget, including:

- Raw material expenditure
- Labor costs
- Environmental and safety compliance costs
- Insurance costs

The next seven slides illustrate energy and non-energy savings.

## Expense Savings (1 of 7)

# Reduced Fuel Bills

- Classic energy efficiency: reduce leaks and losses, so the plant uses less fuel to make the same amount of product.

**Price x Quantity Purchased = Expenditure**

☑ Energy efficiency = less fuel per unit of production

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## Expense Savings (2 of 7)

# Reduce the Average Price of Fuel Purchased

- Energy efficiency = control = predictable consumption
- Predictable consumption = ability to purchase a greater proportion of fuel via fixed-price contracts
- Energy efficiency = reliability: Reduce downtime and the need to run extra shifts on expensive spot-market fuel

**Price** x **Quantity Purchased = Expenditure**

☑ Energy efficiency: predictable consumption volumes and usage patterns gives the facility manager leverage in locking in lower priced, fixed-contract fuel volumes.

Prove it with the plant's energy flow data records.

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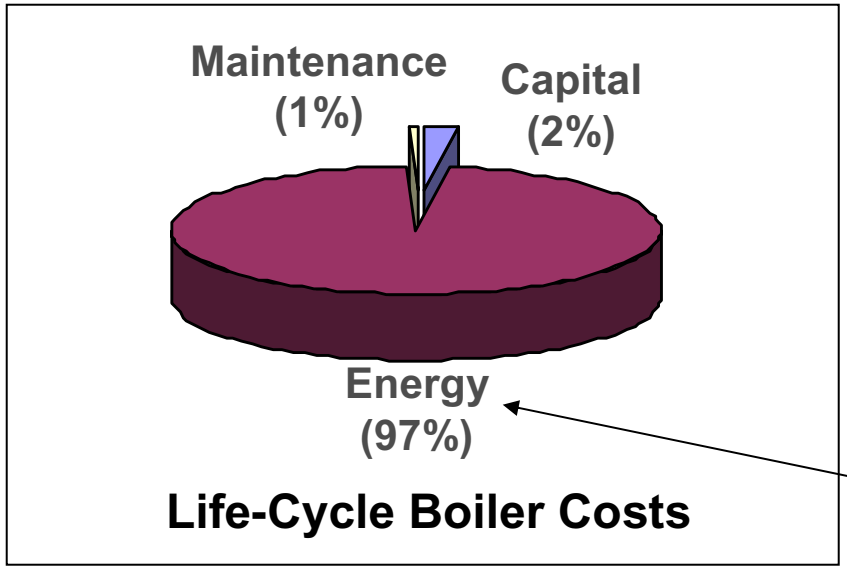
## Expense Savings (3 of 7)

# Catch Utility Bill Errors




- Utilities can and do make mistakes
- Use energy flow management data to balance consumption indicated on utility bills
- **GUESS WHERE THE LARGEST POTENTIAL ACCOUNTING MISTAKES ARE…**

☑ Energy management efforts (data) provide efficiency and also verify fuel procurement and consumption.

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## Expense Savings (4 of 7)

# Reduce Raw Material Waste

- Energy efficiency = control over thermal flows
- Better and more consistent product quality results from the proper application of thermal energy:
  - At the right time
  - At the right temperature
  - In correct proportion to material inputs
- Poor facility management = greater equipment failure and downtime
  - Unexpected process stoppage can ruin works in progress, increase scrap rates.

☑ Energy efficiency improves control over thermal resources. Control allows plants to make better products with less waste of raw materials.

## Expense Savings (5 of 7)

# Lower Hazard Insurance Premiums

- Energy efficiency = closer monitoring of operations = better detection and correction of anomalies = operator's log book includes far fewer problem incidents. This may be leverage with the insurance carrier for a lower premium and/or deductibles.
- The safer plant also faces fewer workman's comp claims and related settlement costs.

☑ Energy efficiency can also pay-off in lower insurance costs.

## Expense Savings (6 of 7)

# Avoided Emissions & Safety Penalties

- Energy efficiency = closer monitoring of operations = better detection and correction of anomalies = fewer opportunities for life and property casualties.
- Emissions output declines proportionately with fossil fuel consumption. A plant with a reduced emissions profile enjoys an extra margin of compliance certainty.
- A lower emissions profile from current plant assets reduces the need for emissions abatement hardware.
- The safer plant also endures fewer OSHA fines.

☑ Energy efficiency hedges against emissions penalties and huge-dollar risks associated with accident settlements.

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## Expense Savings (7 of 7)

# Lower Idle-Resource Costs

- Many plant assets are secured by debt financing. Interest costs associated with debt accrue every second of every day, regardless of plant output.

- Downtime for equipment failure does not stop interest costs from accruing.
  - Interest costs may also apply to raw materials waiting to be used.
  - Direct labor costs may still be incurred as staff wait for repairs to be made.
  - Staff benefits and overhead costs also continue to accrue during work stoppages.

☑ Idle resources still cost money. Efficiency practices boost reliability, which the key to avoiding downtime.

# Revenue Creation

**THE NEXT FOUR SLIDES:**

Get top management's attention by demonstrating energy efficiency's potential for *generating revenue*.

## Revenue Creation (1 of 4)

# Boost Revenue with Improved Plant Capacity

- Energy efficiency facilitates **Speed**, **Flexibility**, and **Product Quality**– all necessary for boosting revenues.
- **SPEED**: Energy efficiency = control of thermal resources = reliability = faster process set-up = faster cycle times = ability to fill more orders = more revenue.
- **FLEXIBILITY**: Energy efficiency = control of thermal resources = higher capacity utilization and reliability = improved utilities platform in support of process activities = ability to support a greater variety of product fabrication.
- **PRODUCT QUALITY:** Energy efficiency = control of thermal resources = control over the timing, volume, and temperature of heat transfer to process materials.

☑ Improve the productivity of current assets AND let the usable proportion of fuel purchases approach 100%.

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## Revenue Creation (2 of 4)

# Demonstrate the Revenue Equivalent of Energy Efficiency

| INCOME STATEMENT | EXAMPLE | Pct. |
|---|---|---|
| Revenue…….. | $1,000,000 | 100% |
| Operating Expenses…. | 900,000 | 90% |
| Operating Profit…… | $100,000 | 10% → Profit margin % |

**OPERATING PROFIT = PROFIT MARGIN% x REVENUE** → **$100,000 = 10% x $1,000,000**

$$\frac{\text{OPERATING PROFIT}}{\text{PROFIT MARGIN\%}} = \text{REVENUE} \rightarrow \frac{\$100{,}000}{10\%} = \$1{,}000{,}000$$

$$\frac{\$1 \text{ Saved}}{10\%} = \$10 \text{ NEW REVENUE} \rightarrow \frac{\$1 \text{ Saved}}{10\%} = \$10 \text{ NEW REVENUE}$$

☑ Top managers prioritize *revenue growth* over *expense savings*. Translate energy efficiency impacts into revenue equivalents.

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## Revenue Creation (3 of 4)

# Equate Energy Savings to Incremental Sales Volume

***Example:***
***Product Price: $100***
***Net annual energy savings = $20,000***

| PROFIT MARGIN | REVENUE EQUIVALENT 0F $20,000 SAVINGS | UNIT SALES EQUIVALENT |
|---|---|---|
| 20% | $100,000 | 1,000 |
| 15% | $133,333 | 1,333 |
| 10% | $200,000 | 2,000 |
| 5% | $400,000 | 4,000 |

☑ If *sales units* are the measure of accountability, even steam managers can demonstrate their contribution.

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## Revenue Creation (4 of 4)

# Secure "Preferred Supplier" Status

- More consumer-product manufacturers are demanding environmentally-friendly supply inputs. They want to assure customers and investors that their products meet "green" standards.
- Many large manufacturers are requiring that input suppliers meet higher standards for emissions and waste impacts.
- If a plant uses less energy, it also produces less emissions.
- Energy management procedures usually help the plant to reduce raw material waste.
- Manufacturers can use energy efficiency to make sure they attain "preferred supplier" status.

☑ Take advantage of growing market demand for environmentally-friendly products and services.

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# Risk Control

**THE NEXT SIX SLIDES:**

Top management craves relief from the ever-increasing risks imposed on business today.

With energy efficiency comes energy *control*, and that control is what offsets risk.

## Risk Control (1 of 6)

# Defend Against Budget Variance (part 1)

- Plant managers usually “take the heat” when unexpectedly large utility bills come in.
- The plant manager’s defense is based on fuel **price and volume variance analysis**.
- **Measuring, monitoring, and verification** activities require the tracking of monthly fuel consumption and price experience.
- Plant managers who implement energy efficiency practices can demonstrate how:
  - consumption remains under control while energy prices vary with market activity.
  - efficiency measures lower consumption, keeping energy **expenditures** below where they *would have been*.

☑ Managers of optimized plants have the means to defend against energy price impacts that are beyond their control.

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## Risk Control (2 of 6)

# Defend Against Budget Variance (part 2)

### EXAMPLE

| Actual Bills | Consumption (therms) | Consump. per Unit | Units Produced | Actual Fuel Price | Actual Fuel Exp. |
|---|---|---|---|---|---|
| Nov-03 experience | 20,700 | 559.5 | 37 | $6.00 | $124,200 |
| Nov-02 experience | 20,000 | 571.4 | 35 | $5.00 | $100,000 |

| Variance Analysis | Consumption (therms) | Consump. per Unit | Units | Fuel Price | Fuel Exp. |
|---|---|---|---|---|---|
| Nov-02 experience | 20,000 | 571.4 | 35 | $5.00 | $100,000 |
| Insert Nov-03 price | 20,000 | 571.4 | 35 | **$6.00** | $120,000 |
| Insert Nov-03 units | 21,143 | 571.4 | **37** | **$6.00** | $126,857 |
| Insert Nov-03 efficiency | 20,700 | **559.5** | **37** | **$6.00** | $124,200 |

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## Risk Control (3 of 6)

# Hedge Against Costs of Energy Market Deregulation

- Deregulated markets generally offer lower commodity prices for fuel, but plant managers face additional costs in search, negotiation, and verification of energy marketer services.
- Energy efficiency = utilization of energy flow data = leverage in securing supplier contracts.
- Plant managers who are better informed about their volume and timing of energy use have far greater leverage with fuel suppliers.
- Measurements of in-plant energy flows “after the meter” are the basis for balancing against fuel purchase invoices. Catch and challenge billing errors.

☑ Energy management activities generate information, which is valuable in the more complex world of energy deregulation.

### Risk Control (4 of 6)

# Hedge Against Evolving Emissions Criteria

- $SO_2$, $NO_x$, carbon, volatile organic compounds, and particulates are all the subject of scrutiny for current or future regulation.
- Emissions output is proportional to fossil fuel consumption. Reducing fuel consumption also reduces emissions output.
- Energy-efficient plants enjoy a larger margin of emissions compliance.
- Operator training covers energy use as well as safety and emissions management.
- Fuel savings due to efficiency are relatively easy to measure. Fines and costs related to emissions penalties are harder to measure, but are best avoided altogether.

☑ Energy management helps to avoid the risks associated with emissions regulation– both today and tomorrow.

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## Risk Control (5 of 6)

# Hedge Against Safety Liabilities

- How many plant managers budget for OSHA violations?
- Safety comes with knowledge…. Knowledge comes with training…. Training is integral to energy optimization.
- Energy efficiency = monitoring, measuring, verification activities = control over operating parameters = fewer surprises = less catastrophic loss = lower legal and settlement costs.

☑ Energy management helps to avoid the risks associated with lapses in plant safety.

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## Risk Control (6 of 6)

# Improve Cost Accounting

- Overhead costs are expenses other than labor, materials, or similar costs that go directly into production. Proper allocation of overhead costs is crucial to plants that manufacture more than one product. Declaration of income, taxes, and profits are at stake. Also, capital budget allocations and production mix decisions are sensitive to proper overhead cost accounting.

- How are overhead costs applied to units of production?
  - Labor hours? Not all workers are paid the same rate. Not all hours are equally productive.
  - Square feet? The value added by a stage of production probably has nothing to do with the size of the area where the production activity took place.

- Energy management data captures the timing of production as well as the volume of energy accruing to each stage of works in progress. For commodity product manufacturing, energy may be consumed in proportion to value-added by stages of production.

☑ Use energy management data to improve overhead cost accounting.

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# Relating Energy Efficiency to "Regular" Business Goals

**THE NEXT FIVE SLIDES:**

Will energy efficiency *detract from* or *contribute to* core business goals?

Businesses are used to investing in order to grow.

The next five slides link energy efficiency to "regular" business investment goals.

## Relating Energy Efficiency to "Regular" Business Goals (1 of 5)

# Open New Markets and Revenue Sources

- New revenue can be generated from better use of current assets. See Slides 8 and 24.
- Large industrial buyers are beginning to demand clean & green products from their suppliers. See Slide 27.

☑ Energy efficiency improves the capacity to generate revenue and enter into emerging "green" markets.

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## Relating Energy Efficiency to "Regular" Business Goals (2 of 5)

# Add Market Share

- Manufacturers serving well-established, slow-growth product markets place a greater emphasis on market share as opposed to growth.
- Market share can be improved by product differentiation– offering a wider variety of products to sustain consumer interest.
- Energy efficiency = improved control of thermal resources = greater process flexibility = ability to generate a wider variety of products = path to enhanced market share. See Slide 24.

☑ The knowledge and practices that provide efficiency also provide process flexibility.

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## Relating Energy Efficiency to "Regular" Business Goals (3 of 5)

# Achieve a Cost Advantage

- Manufacturers participating in competitive commodity markets often focus on cost per unit produced. Tremendous effort goes into shaving pennies off the unit cost of production.
- Data generated from energy flow management duties helps to demonstrate energy efficiency's contribution to expense reduction. See Slides 15-22.

☑ Energy efficiency provides another margin of cost reduction for manufacturers in competitive commodity markets.

## Relating Energy Efficiency to "Regular" Business Goals (4 of 5)

# Generate Cash Flows Within the Business

- For some manufacturers, the challenge is to make the best use of overhead in order to evolve their business in changing markets.
- Reducing *energy expenditures* and other *costs of goods sold* increases **gross margins**, which represent funds available for overhead – including product development and marketing.
- Slides 15-22 illustrate ways that energy efficiency reduces expenses, thus releasing more cash to apply to overhead activities.

☑ Energy efficiency allows a greater proportion of available cash to flow into marketing and development activities.

## Relating Energy Efficiency to "Regular" Business Goals (5 of 5)

# Improve Return on Investment*

- Return on Investment, or "ROI," is a key business performance indicator.

$$\text{ROI} = \text{Profit Margin} \times \text{Asset Turnover}$$

$$\text{ROI} = \frac{\text{Net Operating Income}}{\text{Sales Revenue}} \times \frac{\text{Sales Revenue}}{\text{Average Operating Assets}}$$

  - Profit margin = "cost-price" efficiency
  - Asset turnover = revenue generating power
  - Both together = ROI = financial "productivity"

- Energy efficiency = reduced expenses = improved profit margin
- Energy efficiency = improved capacity utilization = increased production from existing assets = improved asset turnover

☑ Energy efficiency contributes to both components of ROI: profit margin and asset turnover.

*Plant-level

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# Call to Action

**THE NEXT FOUR SLIDES:**

For facility managers who ask:

- *What can I do?*
- *Where do I start?*
- *Who can help me?*

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## Call to Action (1 of 4)

# Do Today

**Identify help in your area:**

NIMAP: www.oit.doe.gov/bestpractices/nimap

- State-by state inventory of low- and no-cost plant assessment services
- Includes Industrial Assessment Centers, utilities, & more

- Get a copy of the **Steam System Assessment Tool**

Everything is on the *Steam CD*, free from the DOE Clearinghouse: (800) 862-2086

- Start collecting and holding your utility bills

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## Call to Action (2 of 4)

# Do this Month

**Get a steam system energy audit**

- Identify opportunities
  - Steam System Scoping Tool: your “discovery” checklist
- Prioritize:  what to do first
  - Steam System Assessment Tool
    Evaluate costs and savings before you commit
- See how it’s done
  - Steam Sourcebook, Tip Sheets, Case Studies
- Start tracking history: fuel bills vs. production per month

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## Call to Action (3 of 4)

# Do by the End of the Year

- **Implement your best opportunity**

- In-house staff?
  or
- Engineering consultant?

- Use BestPractices Tools
  - as do-it-yourself reference
  - way to check vendor claims
  - leverage on vendor prices

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Call to Action (4 of 4)

# Starting Next Year

## Sustainable Energy Management

- Annual energy use targets
  - Steam/product ratios
  - Cost per 1,000 lbs. of steam
- Goals, accountability, rewards
  - Compare yourself to last year
  - Your fuel bill data:  good defense, good case for additional improvements

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# Additional References

- *Steam Efficiency: Impacts from Boilers to the Boardroom* (C. Russell)
  www.ase.org/steamingahead/library/boilertoboard.pdf
- *Justifying Energy Efficiency Projects to Management* (C. Russell)
  www.ase.org/steamingahead/library/justifying.pdf
- *Cash Flow Impacts of Steam Efficiency* (C. Russell)
  www.ase.org/steamingahead/archives/2003_07-08.htm
- *The Dirty Dozen of Energy Efficiency Waste* (Fred Schoeneborn)
  http://www.ase.org/steamingahead/archives/2003_07-08_links/dirtydozen.pdf
- *Enbridge Gas Distribution's Steam Saver Program Results* (Bob Griffin)
  (66 steam plant audits, summary report)
  www.ase.org/steamingahead/archives/misc_links/enbridge03.pdf

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