

Identifying Hidden Energy Losses in Industrial Manufacturing Facilities



Steven Schultz
Corporate Energy Manager
3M



3M Energy Management

Six Market-Leading Businesses

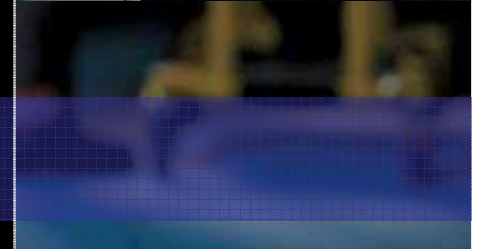
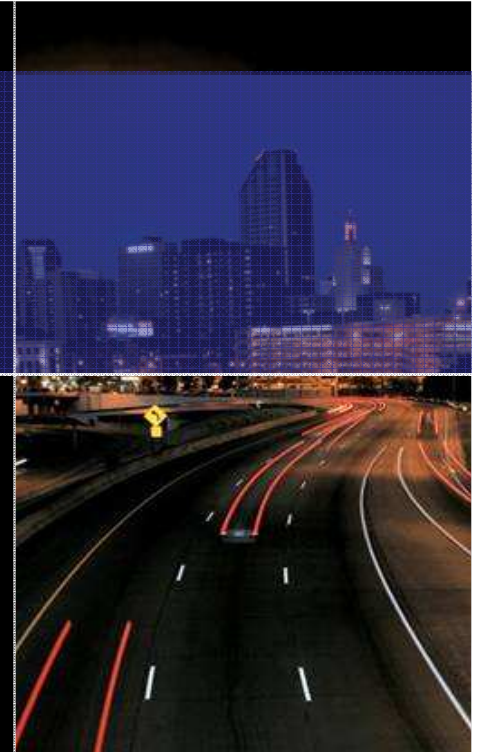
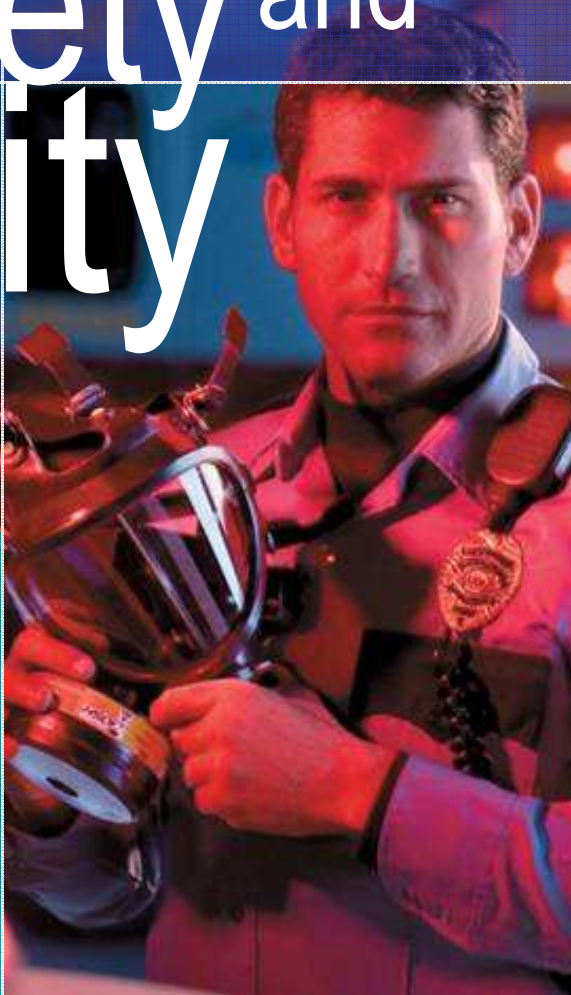




Leading Through
Innovation

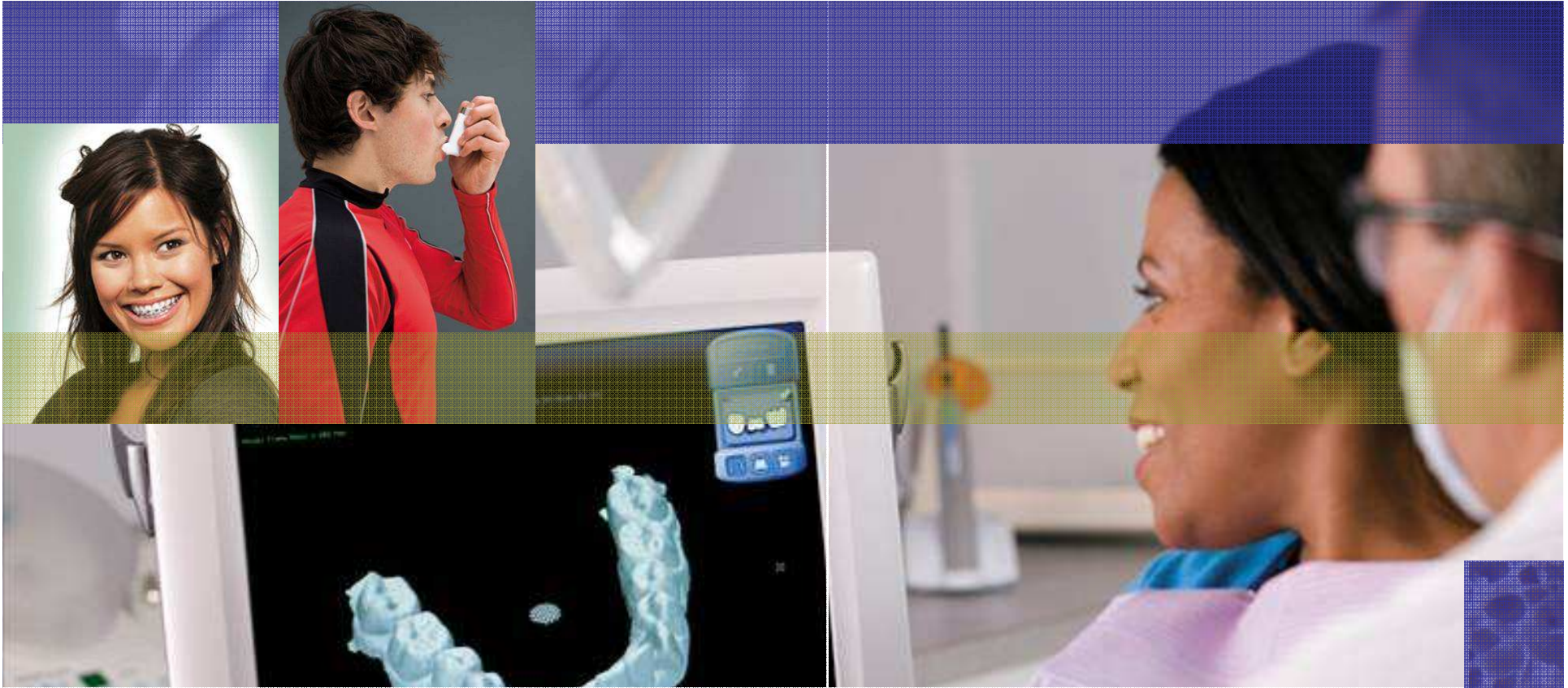
S. LAB

Enhancing safety and security



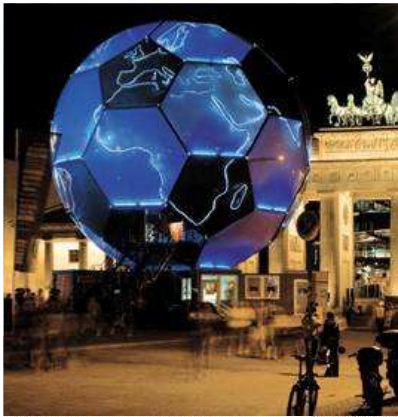


Making
life better around the home



Improving the
quality of
health care





Always
adding value

for business

Our Values

- Act with uncompromising honesty and integrity in everything we do
- Satisfy our customers with innovative technology and superior quality, value and service
- Provide our investors an attractive return through sustainable, global growth
- Respect our social and physical environment around the world
- Value and develop our employees' diverse talents, initiative and leadership
- Earn the admiration of all those associated with 3M worldwide



3M Environmental, Health and Safety

3M's Sustainability Strategy



Together in Growth
Sustaining our Future

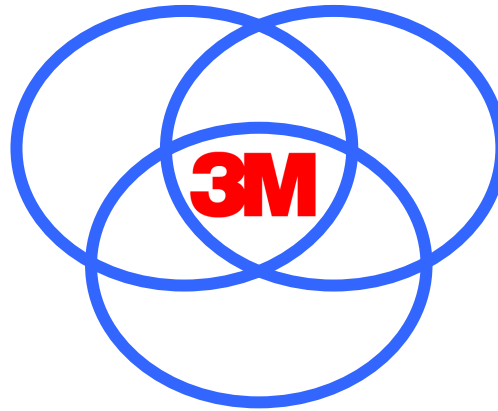


What is “Sustainability”?



Economic
Success

Environmental
Protection



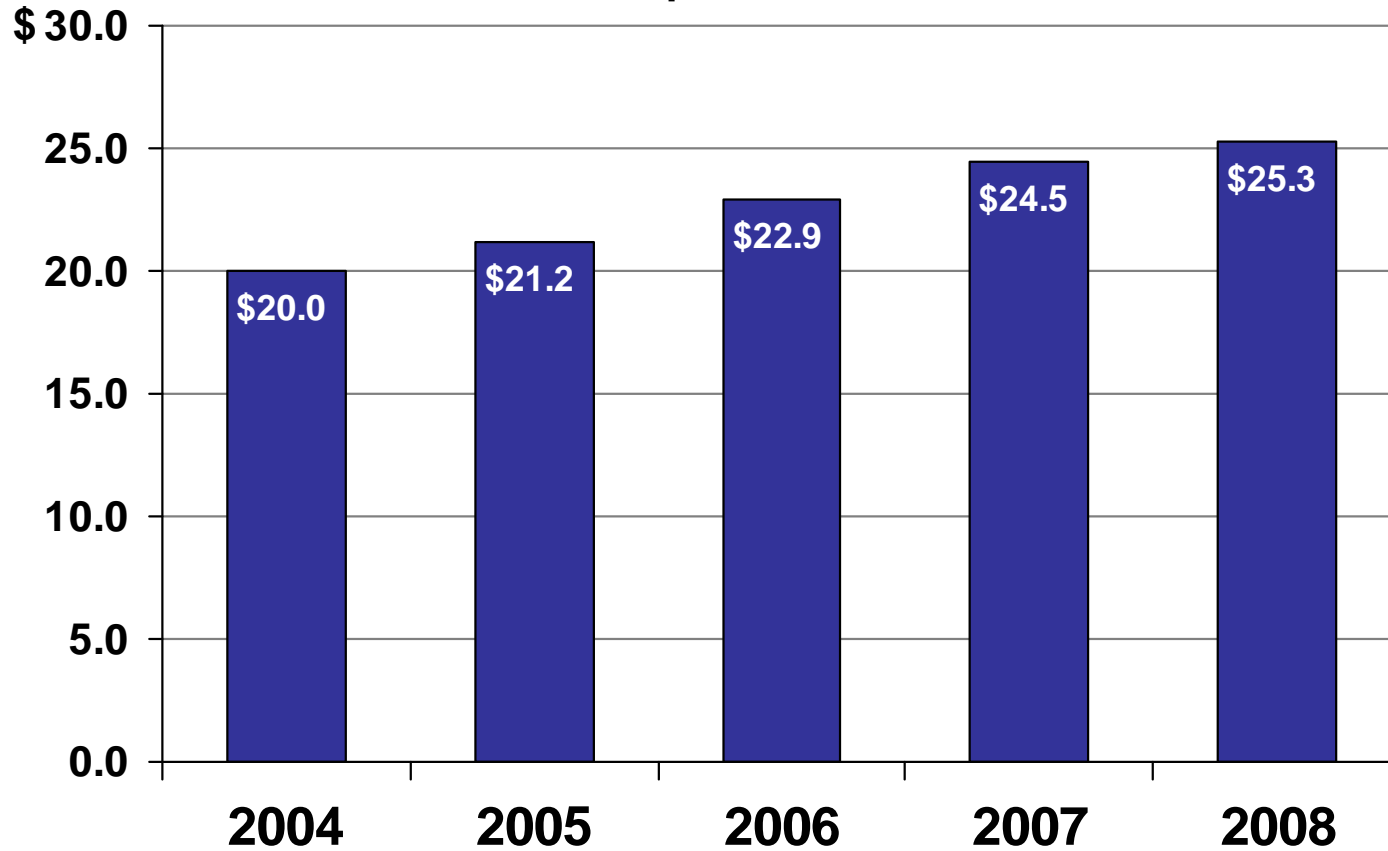
Social
Responsibility

*“Meeting the Needs of Society Today, While Respecting
the Ability of Future Generations to Meet Their Needs”*



Net Sales (billions)

Solid Top-Line Growth



3M Energy Management



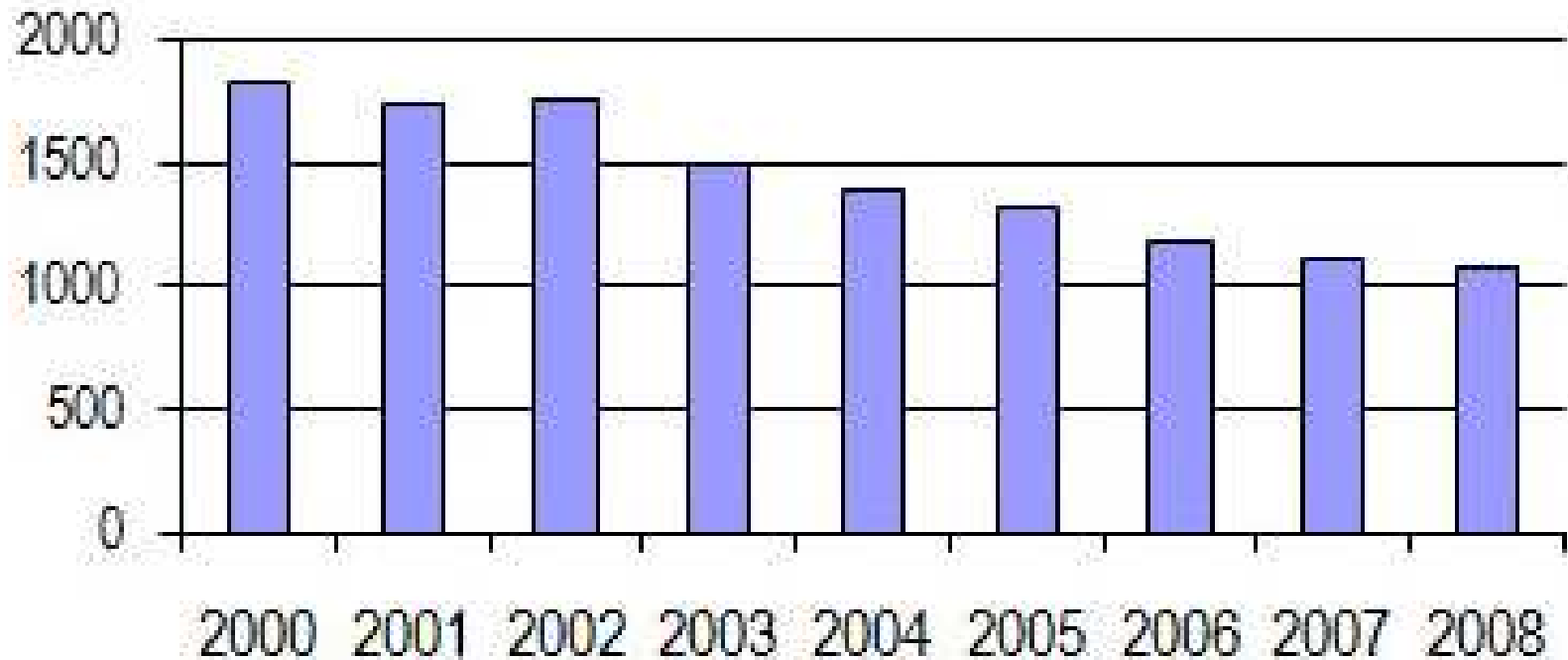
Driving Down Energy Costs

Making Energy Efficiency A Competitive Advantage



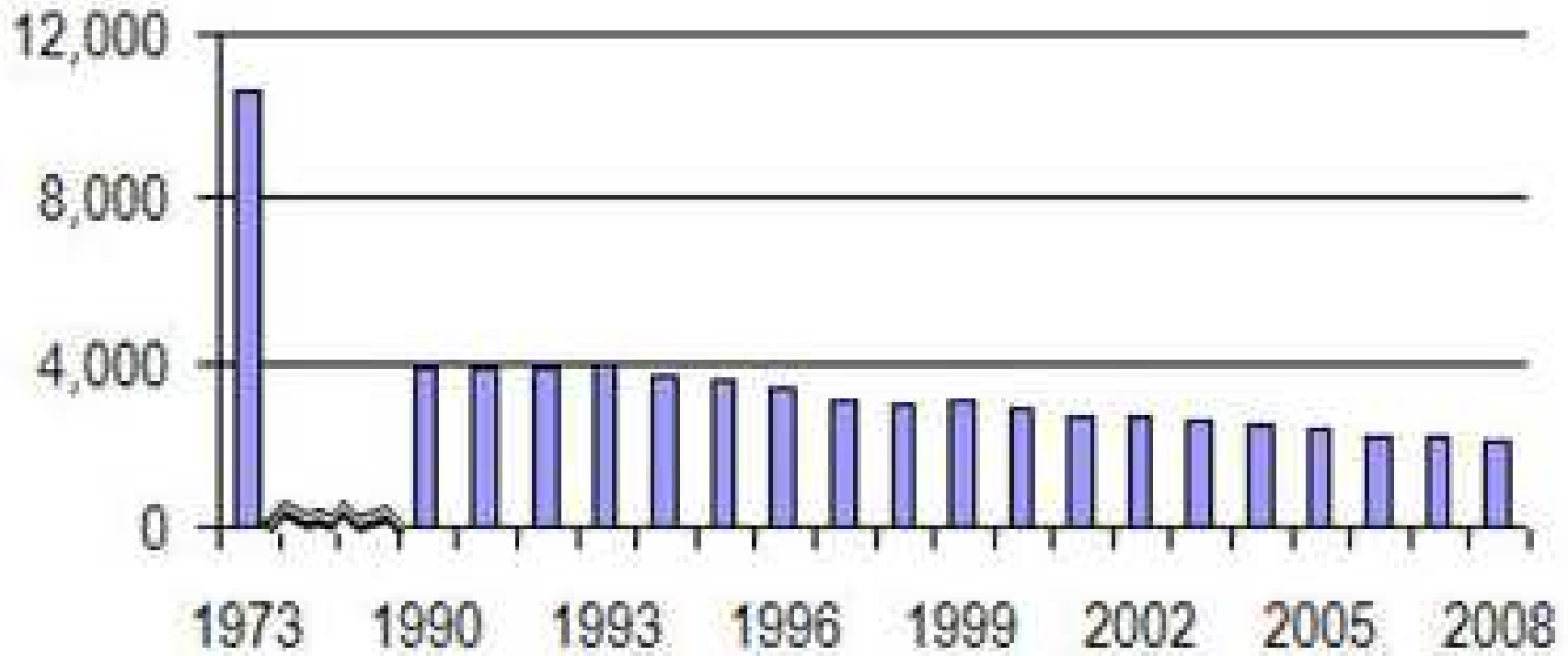
3M Worldwide Energy Use

Million Btu's of Energy / Millions \$ Sales



3M U.S. Energy Use

Million Btu's of Energy

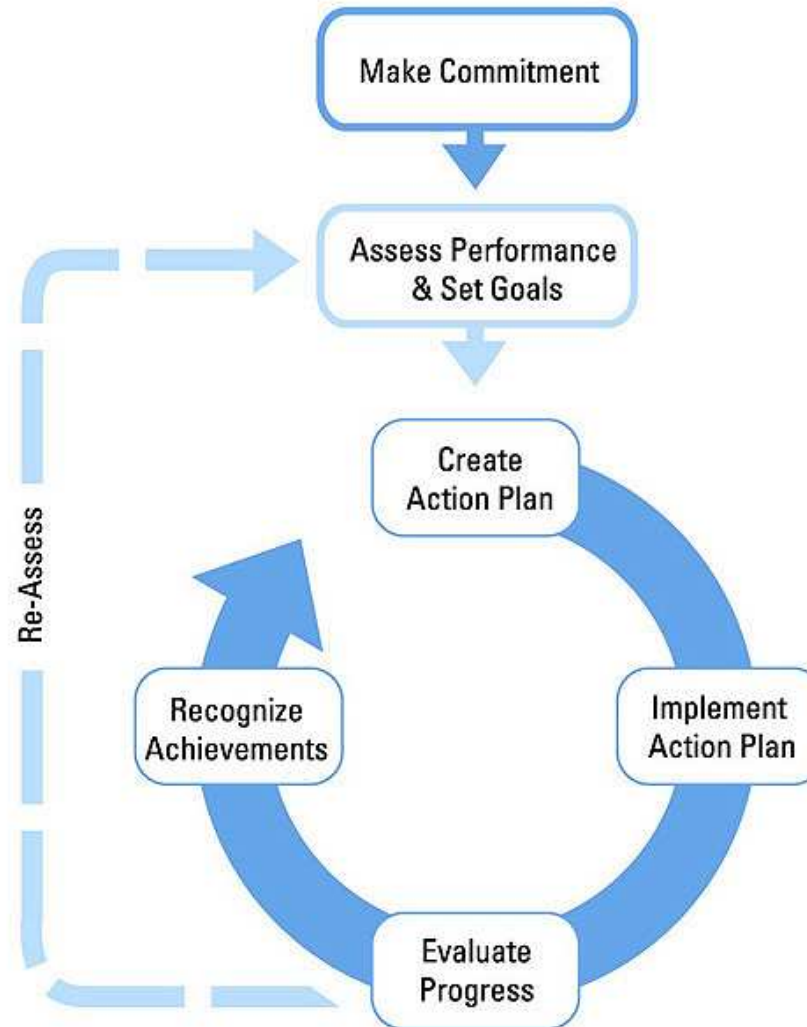




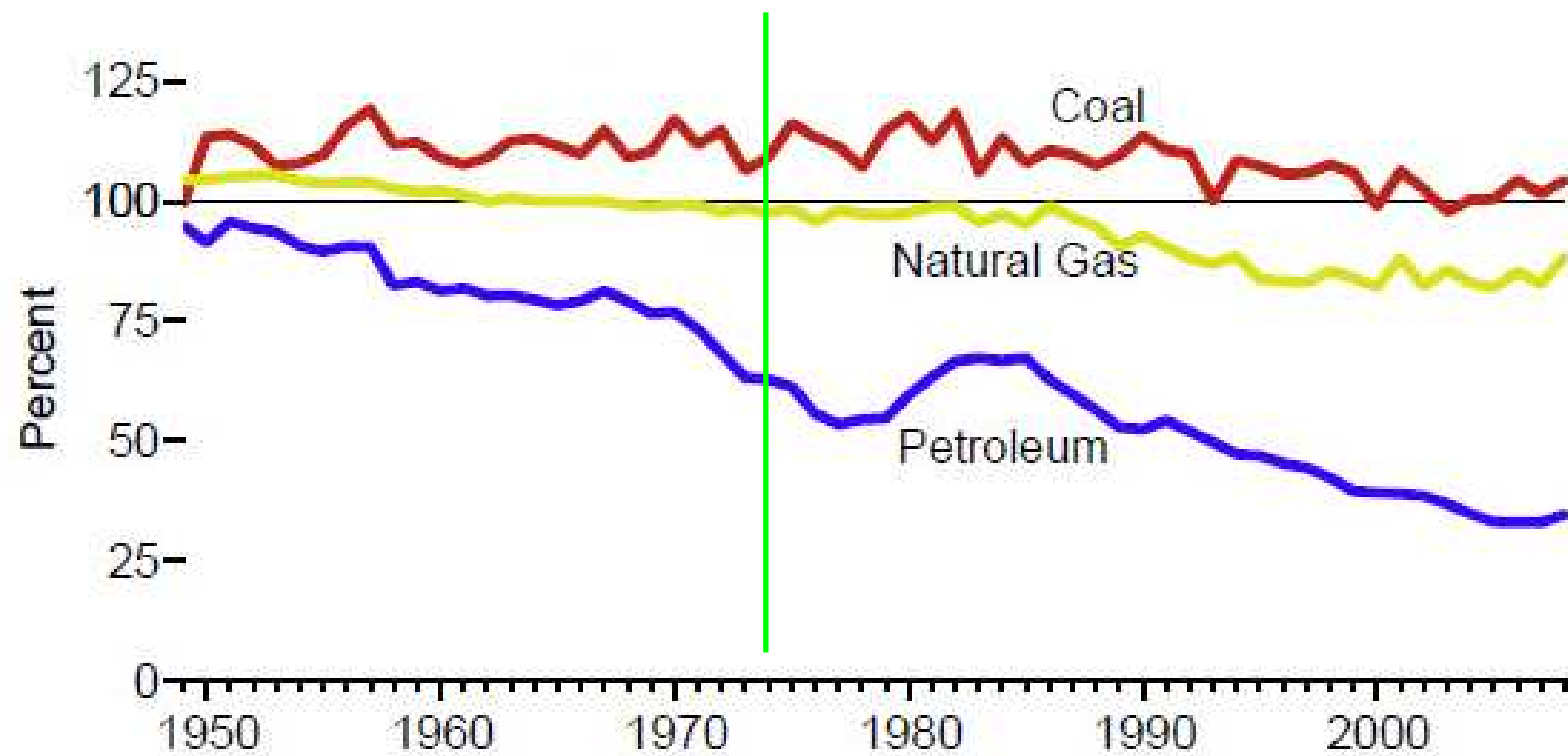
SUSTAINED EXCELLENCE

ENERGY STAR®: Guidelines for Energy Management

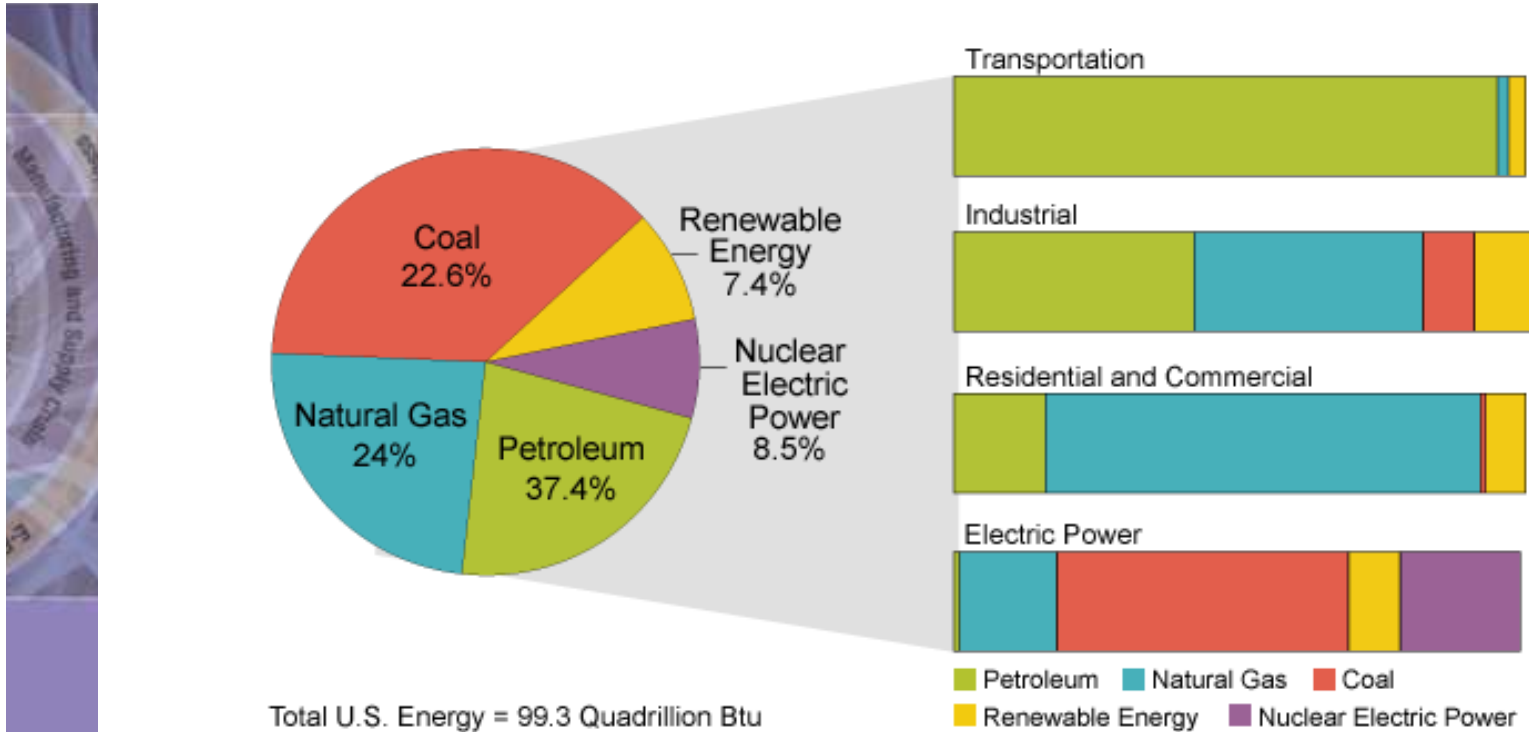
- Management System for Energy
 - 3M is using this approach recommended by ENERGY STAR



United States Energy Production as a Percent of Consumption



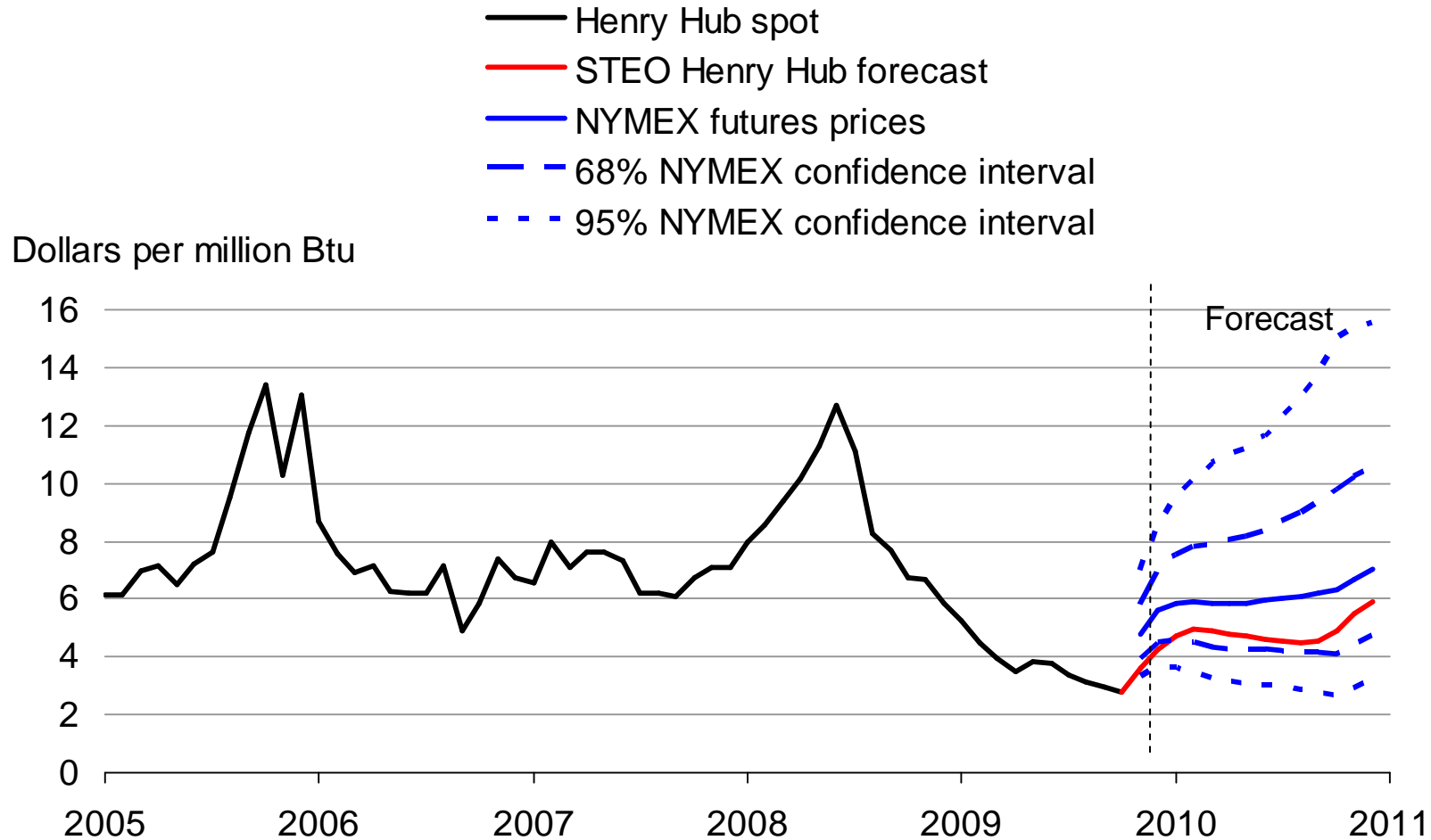
United States Primary Energy Consumption by Source and Sector, 2008



Source: Energy Information Administration, *Annual Energy Review 2008*, Tables 1.3, 2.1b-2.1f, 10.3, and 10.4.



Henry Hub Natural Gas Spot Prices Remain Highly Uncertain



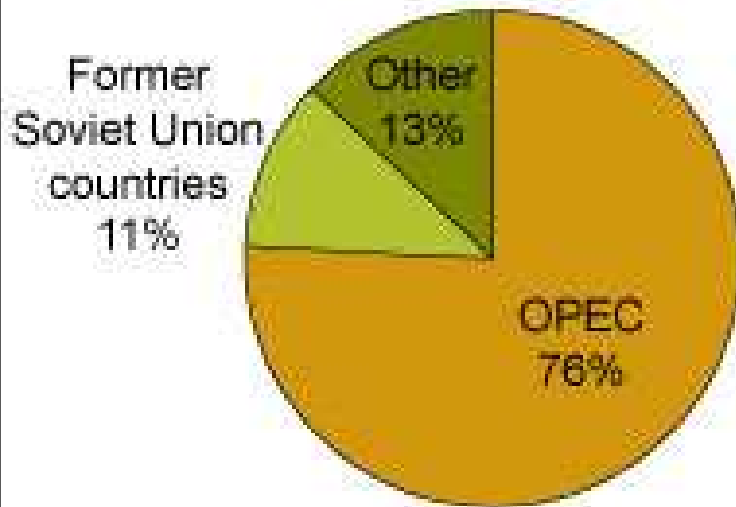
Source: STEO October 2009.



Access to Proven Oil Reserves

OPEC member countries held over three-quarters of the world's proven oil reserves at the end of 2006.

Proven Oil Reserves Holders

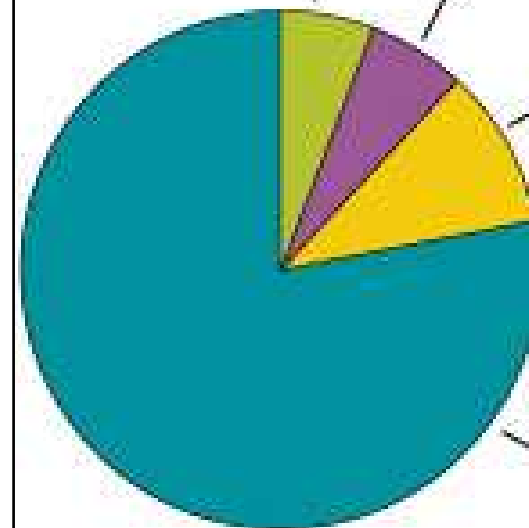


Source: BP Statistical Review of World Energy (2007)

Reserves to which International Oil Companies have Full Access 6%

Reserves Held by New Russian Companies 6%

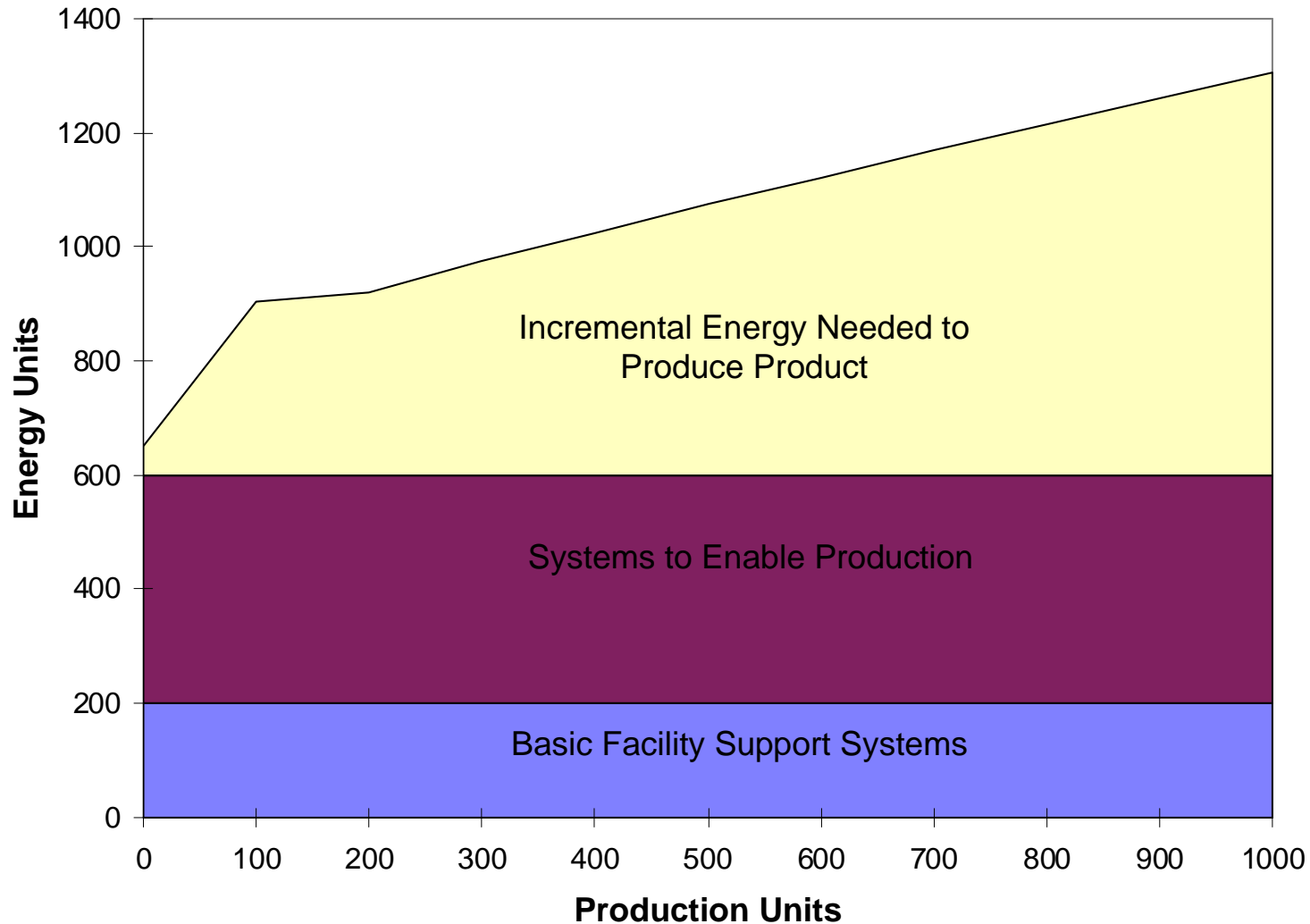
Reserves Held by National Oil Companies (equity access) 10%



Reserves Held by National Oil Companies (limited equity access) 78%

Source: PFC Energy, 2008

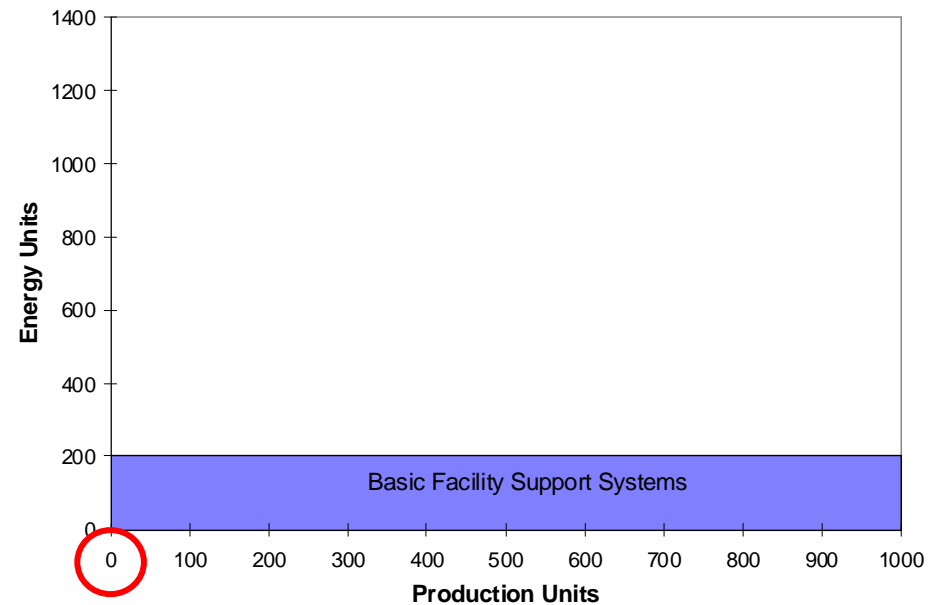
Identifying Hidden Energy Losses – Where is the energy going?



Identifying Hidden Energy Losses – Where is the energy going?

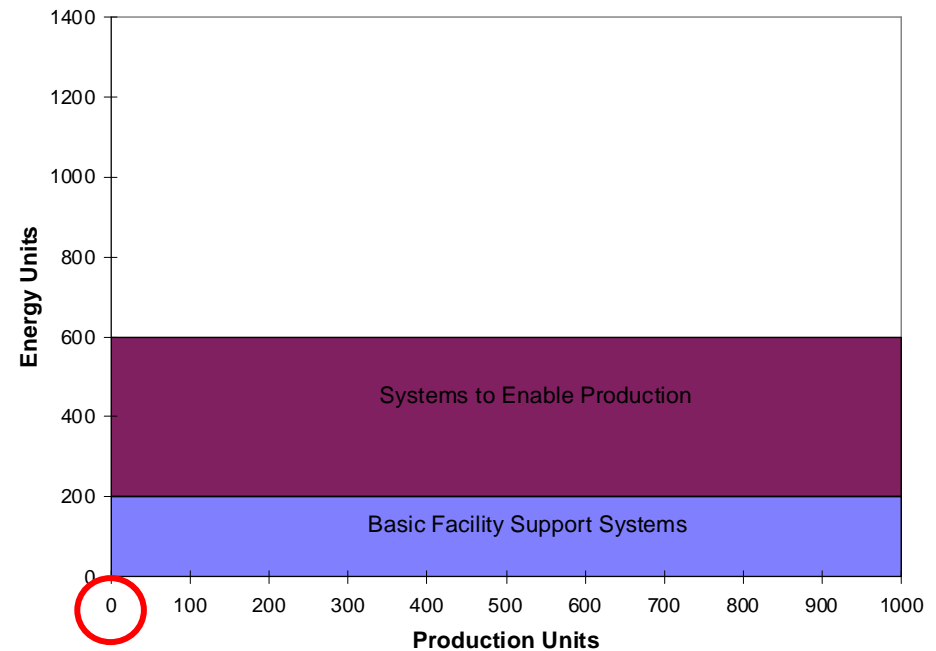
■ Basic Facility Support Systems

- *Lighting*
- *Ambient Air Handling*
- *Domestic Water*
- *Hot Water Systems*
- *Vending Machines*
- *Water Coolers*
- *System Losses*
- *Building Losses*
- *Miscellaneous*



Identifying Hidden Energy Losses – Where is the energy going?

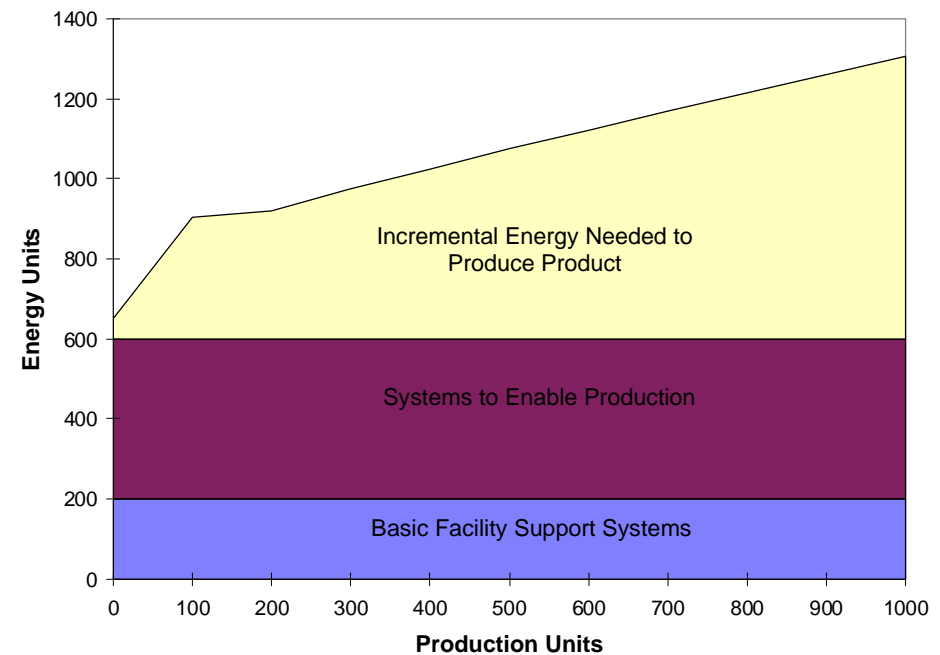
- Systems to Enable Production
 - *Process Air Handling Equipment*
 - *Emission Control Equipment*
 - *Air Supply and Exhaust Systems*
 - *Compressed Air Systems*
 - *Chillers*
 - *Ovens*
 - *Pumps*
 - *Material Handling*
 - *Conveyors*
 - *Pneumatic*
 - *Overhead*



Identifying Hidden Energy Losses – Where is the energy going?

■ Incremental Energy Needed to Produce Product

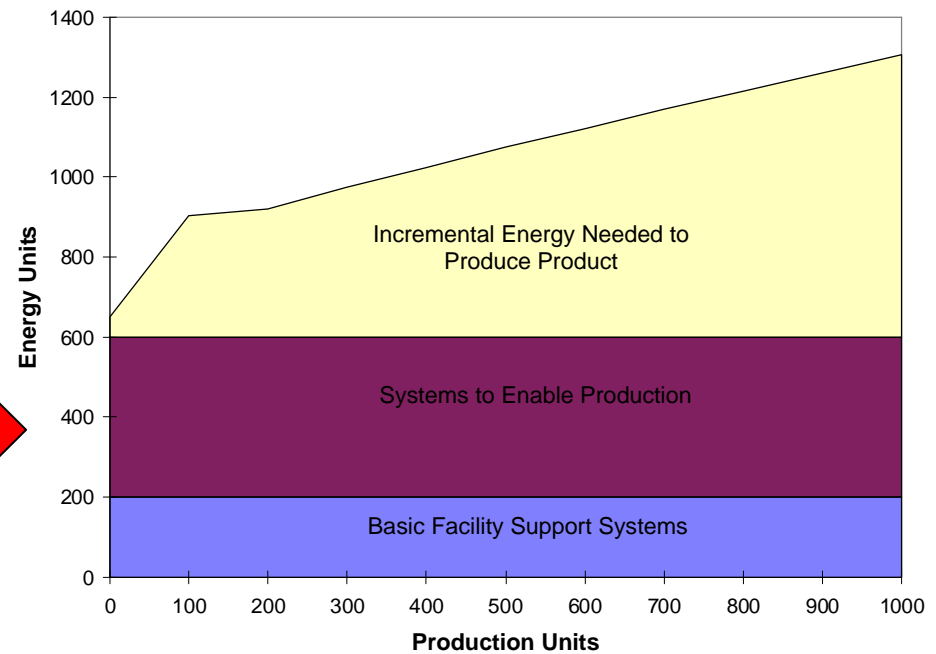
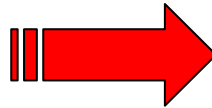
- *Preparation*
- *Direct Processing*
- *Heating*
- *Cooling*
- *Assembly*
- *Testing*
- *Packaging*
- *Material Handling*
 - *Lift Trucks*



Identifying Hidden Energy Losses



- Systems to Enable Production
 - *Process Air Handling Equipment*
 - *Emission Control Equipment*
 - *Air Supply and Exhaust Systems*
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Identifying Hidden Energy Losses – 3M Best Practice

- **Non production days shutdown**
 - *It was identified that the plant consumed more energy than thought on non production days.*
 - *The energy team performed Energy Audit on non production days identifying energy sources that could be shut-off.*
 - *Extended Shutdown Checklist was created.*
 - *HVAC, compressed air, lightning and chilled water systems were identified as major energy consumers during non production days*
 - *Small compressor was installed for equipment requiring compressed air on non production days*



Identifying Hidden Energy Losses – 3M Best Practice

■ Air Handlers Shutdown and Controls

- *HVAC units are controlled from the common platform and on schedule*
- *HVAC units were re-commissioned last summer - many issues found and corrected*
- *HVAC temperature control was changed from room temperature to supply air temperature.*
- *Production HVAC units are ducted for spot heating/cooling*
- *Units tried to maintain room temperature set point - impossible task in the plant with large production dryers (or any kind of heat generating equipment). They now control supply air temperature for better comfort and less energy consumption.*



Identifying Hidden Energy Losses – 3M Best Practice

- **Plant Energy Conservation Awareness program**
 - *Energy Conservation posters placed throughout the plant*
 - *Energy Conservation stickers placed on energy shut off points like disconnects, compressed valves and light switches.*
 - *All office PC have “Turn It Off” stickers reminding users to switch them off when not in use.*
 - *Weekly, Monthly and Quarterly energy communication notes sent to the plant including conservation progress reports and general awareness notes.*
 - *All employees were encouraged to participate in energy conservation in the plant and programs like Earth Day.*

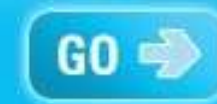




CHANGE THE WORLD,
start with **ENERGY STAR**[®]



Take the ENERGY STAR Pledge





Take the ENERGY STAR pledge.

I will do my part to save energy and help fight global warming. I pledge to:

Change a Light (Want to do more? See below!)

Replace at least one light in my home with an ENERGY STAR qualified one. [?](#)

I plan to replace lights (max. 50)

Do Even More

Make my home heating and cooling system work better. I will: [?](#)

- Set or program my thermostat to save energy while I'm asleep or away from home
- Have my heating and cooling equipment tuned-up by a professional and change my air filter
- Seal obvious leaks and repair disconnections in my home's duct system

Make sure my home is well sealed and insulated. I will: [?](#)

- Seal my home's envelope (outer walls, ceiling, windows, doors, and floors) with caulk, spray foam, or weather stripping, and add insulation to the attic

Choose ENERGY STAR qualified equipment for my home office. I plan to purchase a(n): [?](#)

See Our Collective Impact



[Click to Enlarge Map >](#)

Individuals: 2,286,057

Greenhouse Gas: 5,921,853,812 lbs

Dollars: 433,915,064

kWh: 3,702,007,492

[About these numbers](#)


Who's Driving the Pledge?

Top 5

All Categories [v](#)



Identifying Hidden Energy Losses – Industry Benchmarking

- 
- Employee involvement at every level
 - Track and measure energy use
 - Standardized procedures for equipment operation
 - Maximize one line for 100% production instead of two lines
 - Move production to 4 days – shutdown equipment on 5th day
 - Consolidate operations within a facility, turn off other areas
 - Use extra people for energy projects
 - Establish focused energy teams

Identifying Hidden Energy Losses – Industry Benchmarking

- Go after the obvious – shut down pumps, fans, lights, ovens that are not needed
- Run at full production and then shut down
- Consider operating off-peak and investigating other demand control opportunities. Understand your rate schedules.
- Utilize energy SWAT teams to identify equipment that can be shut down



Identifying Hidden Energy Losses – Industry Benchmarking

- Track energy use on a hourly basis
- Raise awareness
- Conduct energy kaizen events
- Develop standard operating procedures for equipment
- Understand your utility rate tariffs



Identifying Hidden Energy Losses – Common Themes

- Track energy use on a hourly basis. Understand where and when energy is being used.
- Operate equipment only to the level needed. Don't over-dry, over-heat or over-process.
- Raise awareness
- Conduct energy kaizen events
- Develop standard operating procedures for equipment
- Understand your utility rate tariffs. Consider shifting operating schedules.
- Maximize production and then shut down
- Use extra people and downtime to implement energy projects



Resources Available

- *Teaming Up To Save Energy* is a “how to” guide on building an energy management program





Innovation

