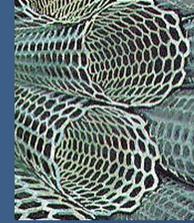




U.S. Department of Energy
**Energy Efficiency
and Renewable Energy**
Bringing you a prosperous future where energy
is clean, abundant, reliable, and affordable



U.S. Department of Energy,
Industrial Technologies Program

Boiler Efficiency Workshop



Robert Gemmer
Technology Manager
May 2008

**Save
ENERGY
Now**



U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

A Highly Successful Program

Each year, ITP activities

- Save as much energy as that used by 2 million American households per year
- Reduce carbon emissions at a level equivalent to taking 6 million mid-sized cars off the road each year
- Retain jobs in the vital manufacturing sector and spur creation of jobs in other sectors of the economy



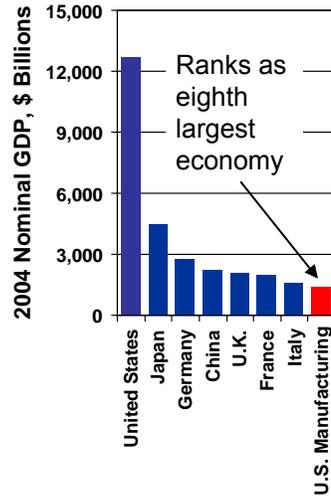
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Industry: Critical to U.S. Economic & Energy Security

The U.S. manufacturing sector

- Consumes more energy than any sector of the economy
- Makes highest contribution to GDP (12%)
- Produces nearly 1/4th of world manufacturing output
- Supplies >60% of US exports, worth \$50 billion/month
- Employs 14 million people
- Spurs job creation and investment in other sectors



3



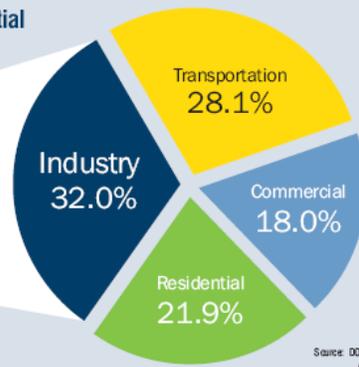
Industrial Technologies Program (ITP): Mission

Improve our nation's energy security, climate, environment, and economic competitiveness by transforming the way U.S. industry uses energy

Reducing U.S. industrial energy intensity is essential to achieving national energy and carbon goals

Petroleum	38.1%
Natural Gas	33.3%
Electricity*	13.5%
Coal and Coke	8.5%
Renewable Energy	6.6%

* Excludes losses



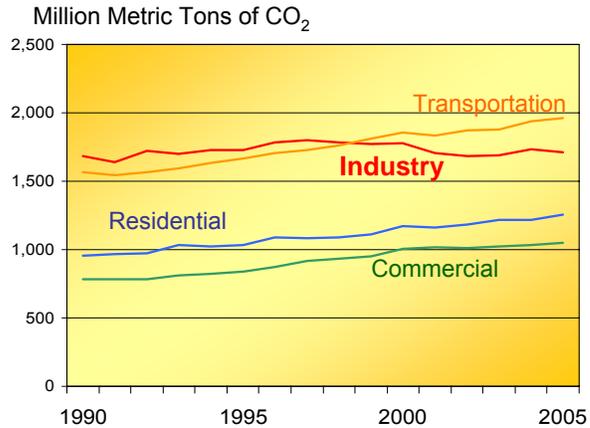
Source: DOE Energy Information Administration, 2006



Industry's Energy and Carbon Reduction Prospects

A recent McKinsey study stated energy efficiency is the most cost-effective carbon reduction option

- Industry represents 38% of the total global opportunity for reducing carbon through energy efficiency

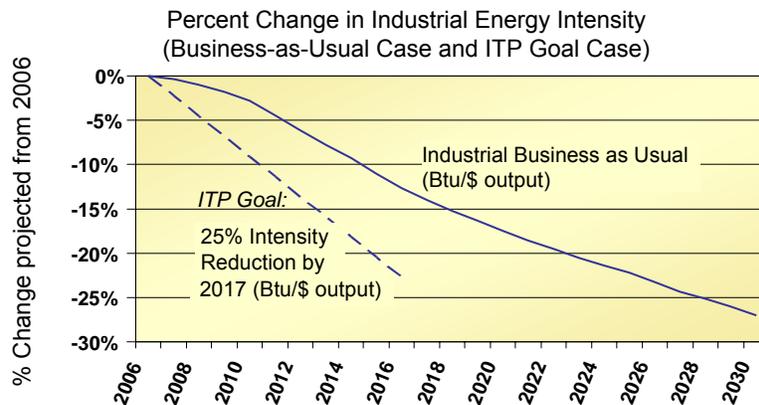


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Our Goal

Drive a 25% reduction in U.S. industrial energy intensity by 2017 in support of *EPA Act 2005* and the *President's carbon reduction goals*.



Source: EIA, AEO 2007, Business As Usual (BAU) case

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ITP Delivers Technology Solutions



Energy Efficiency R&D
 Develop cross-cutting technologies addressing the top energy savings opportunities across industry



Fuel and Feedstock Flexibility
 Accelerate market penetration of emerging options for alternative fuels and feedstock; also CHP



Technology Delivery
 Help plants save energy today by assessing opportunities and facilitating adoption of best energy management practices and efficient new technologies



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Energy Efficiency R&D

- **Industry-specific R&D** to address top priorities in America's most energy-intensive industries
 - Aluminum
 - Chemicals
 - Forest Products
 - Metal Casting
 - Steel
 - Information Technology and Data Centers
- **Crosscutting R&D** to develop technologies applicable to multiple industrial subsectors
 - Energy Intensive Process R&D
 - Industrial Materials
 - Sensors and Automation
 - Combustion
 - Fuel and Feedstock Flexibility
 - Industrial Distributed Generation
 - Advanced Reciprocating Engines
 - Clean Heat and Power (CHP)
 - Nanomanufacturing



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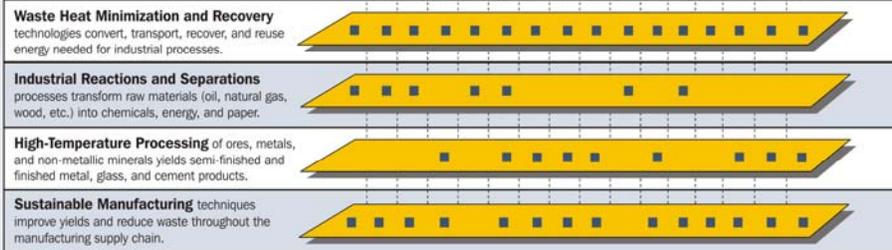


Energy Intensive Process R&D “Platforms”

R&D in Four Cross-cutting Technology Areas Can Achieve Large Energy Benefits in Multiple Industries

Industries (Ranked by Fuel and Electricity Use)

Chemicals (1)
 Petroleum Refining (2)
 Forest Products (3)
 Iron & Steel Mills (4)
 Food & Beverage (5)
 Mining (6)
 Transportation Equip. (7)
 Alumina & Aluminum (8)
 Fabricated Metals (9)
 Textiles (10)
 Cement (11)
 Plastics (11)
 Computers, Electronics (12)
 Glass & Glass Products (14)
 Foundries (15)
 Heavy Machinery (16)



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R&D Highlight: SuperBoiler

- Data from demonstrations currently being collected, with first commercial sale expected in 2009
- The Super Boiler offers a fuel-to-steam conversion efficiency of more than 94% (vs 85% for today's best boilers)
- Has applications in almost every industrial subsector
- By 2020, this technology could
 - Save over \$1 billion a year in energy costs
 - Dramatically cut NOx and greenhouse gas emissions
- FY08 demonstration at Clement Pappas fruit processing facility in Ontario, California



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Fuel and Feedstock Flexibility

- **Flexibility activities** that take advantage of the large opportunity for fuel diversification through industrial use of non-traditional fuels and feedstocks such as industrial waste streams
 - Process integration activities
 - Technology validation
- **Industrial distributed energy activities** to spur widespread commercial use of CHP and other distributed generation solutions (e.g., advanced reciprocating engines) throughout the nation
 - Technology development and validation
 - Market transformation activities

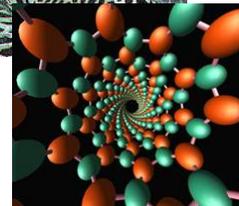
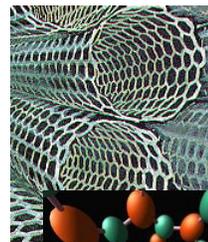


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Nanomanufacturing

- ITP is helping transform nanoscience discoveries into real-world solutions that will lead the next industrial revolution
- Our goal is to enable mass production and application of nanotechnologies that could transform industrial processes
 - Manufacturing techniques for cost-competitive, large-scale production of nanomaterials
 - Methods to integrate nanomaterials into intermediate and finished products



View down middle of a boron nitride nanotube.

The U.S. government has invested >\$8 billion in nanotechnology science over the past seven year. ITP's applied research in nanomanufacturing will help realize this technology's vast potential.

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Credit: © Vin Crespi, Penn State Physics. Distributed under the Creative Commons license



Energy-Efficient Data Centers

- Data centers are a huge growth industry with rising electricity demand
- We are pursuing multiple avenues:
 - R&D on advanced cooling, DC power, and optimized power management concepts
 - Energy assessments
 - Promotion of best practices
 - Demonstrations of proven, best-available technologies held at federal and state facilities



ITP is partnering with FEMP, end users, suppliers, utilities, and states to address the tremendous opportunity to build energy efficiency into the U.S. data center infrastructure.



Technology Delivery Products & Services

Software Tools

- Process Heating
- Steam Systems
- Plant Energy Profiler
- Motors & Pumps
- Fans

Plant Assessments

- Energy Saving Assessments (ESAs)
- Industrial Assessment Center Audits



Training

- Basic
- Advanced
- Qualified Specialist

Information

- Website
- Information Center
- Tip Sheets
- Case studies
- Webcasts





Energy Assessments Success

- 526 assessments completed
- Average plant found ways to reduce energy bill by about 8%
- With 447 plants reporting identified savings:

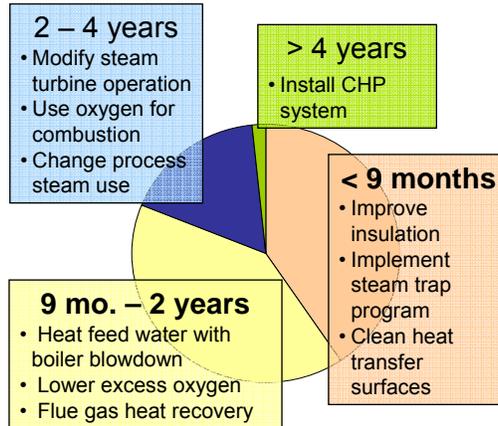
Identified energy savings:
80 TBtu/\$750 million

Total potential carbon dioxide emissions reduction:
6.4 million metric tons

- With 305 plants reporting implementation energy savings:

Implemented:
20 TBtu/\$112 million

In-progress or planned:
23 TBtu/\$303 million



Estimated Payback Periods for Recommended Actions

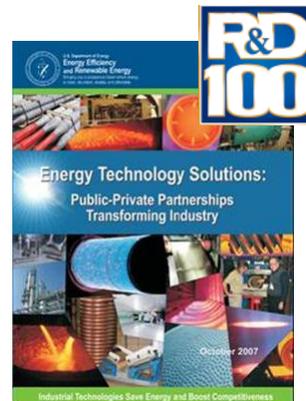
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ITP Delivers Results

Together with industry, we have successfully developed and moved cutting-edge technologies and energy-saving measures into practice

- Received 42 R&D 100 awards between 1991 and 2007
- Commercialized over 220 technologies since program inception
 - 5 quads of energy savings
 - 86 MMTcE reduction
- Over 16,000 U.S. manufacturing plants using ITP software and best practices
- Resulted in 235 U.S. patents issued since 1990



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Save 
ENERGY
 **Now**