# US Department of Energy
# Industrial Technologies Program

## CHP in Industry/ ITP Overview

## Florida CHP and Sustainability Workshop

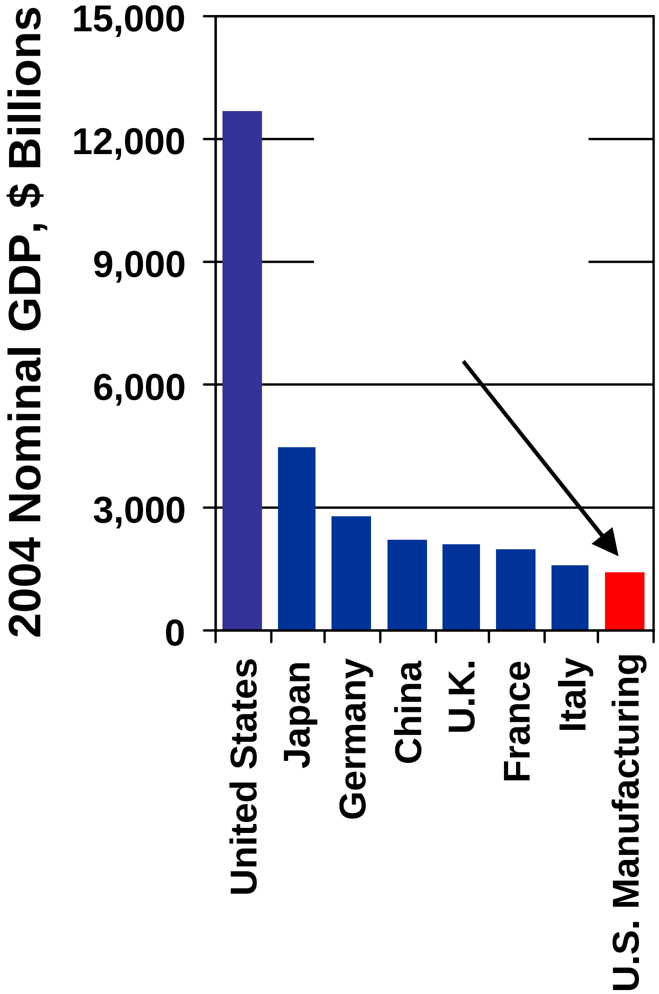
## August 10, 2008

Debbie Weems

# Industry is Critical to U.S. Economic & Energy Security

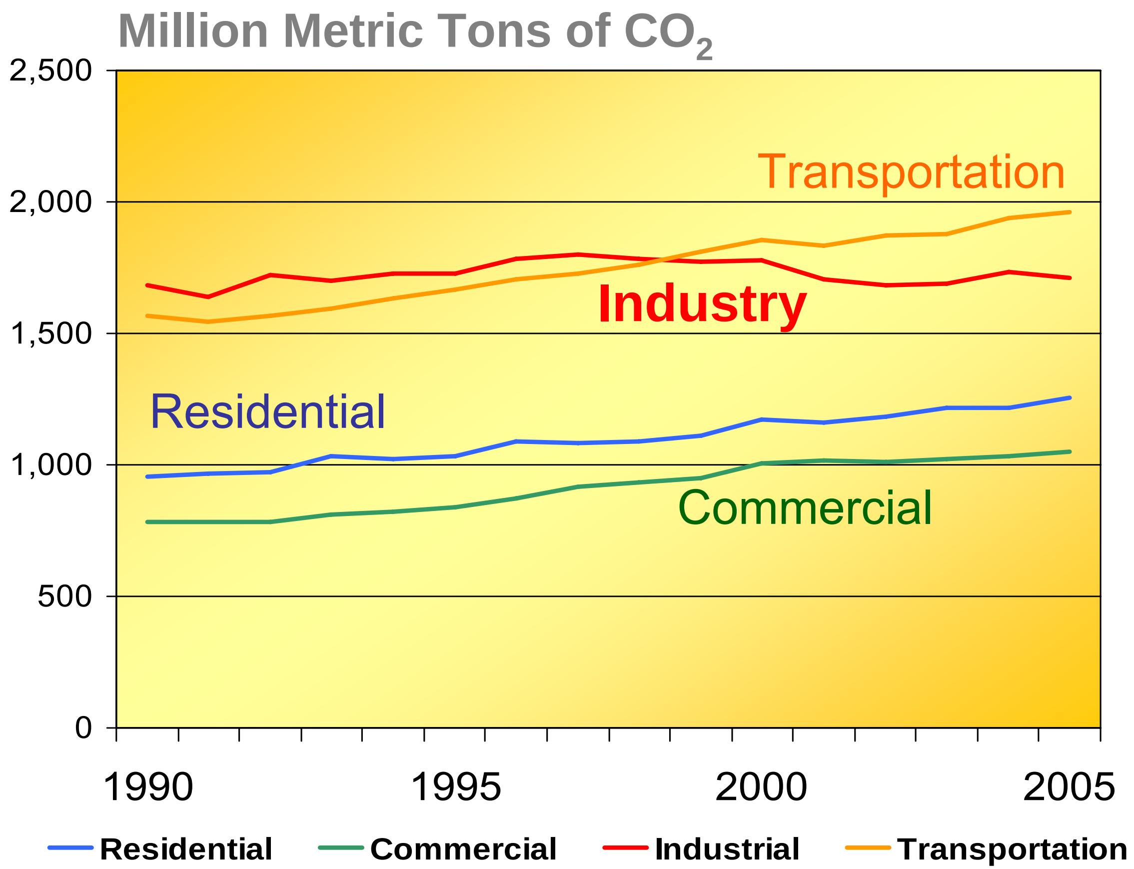
*The U.S. manufacturing sector*

- 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



# Prime Target for Energy and Carbon Reductions

- Industry has already begun reducing its carbon intensity
- 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



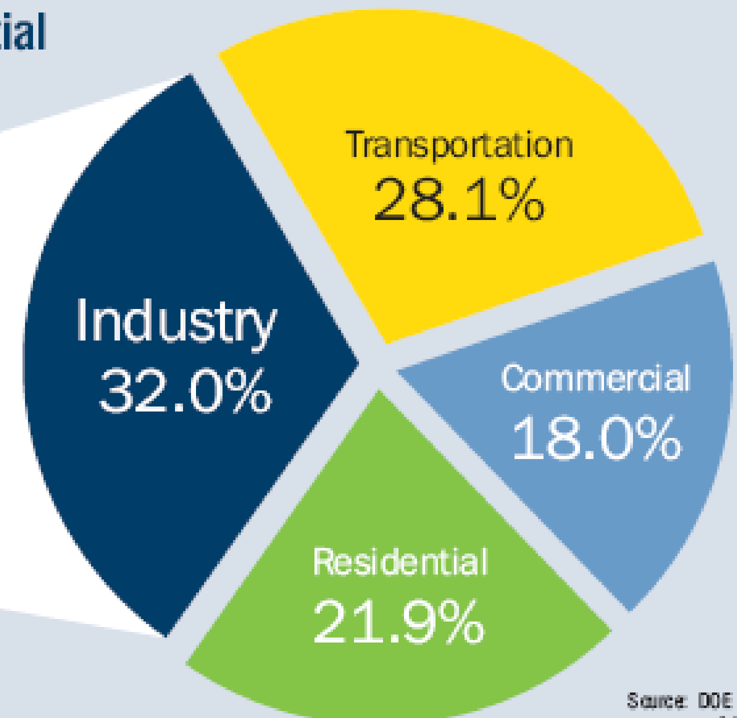
# Industrial Technologies Program: Mission

*Improve national 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**

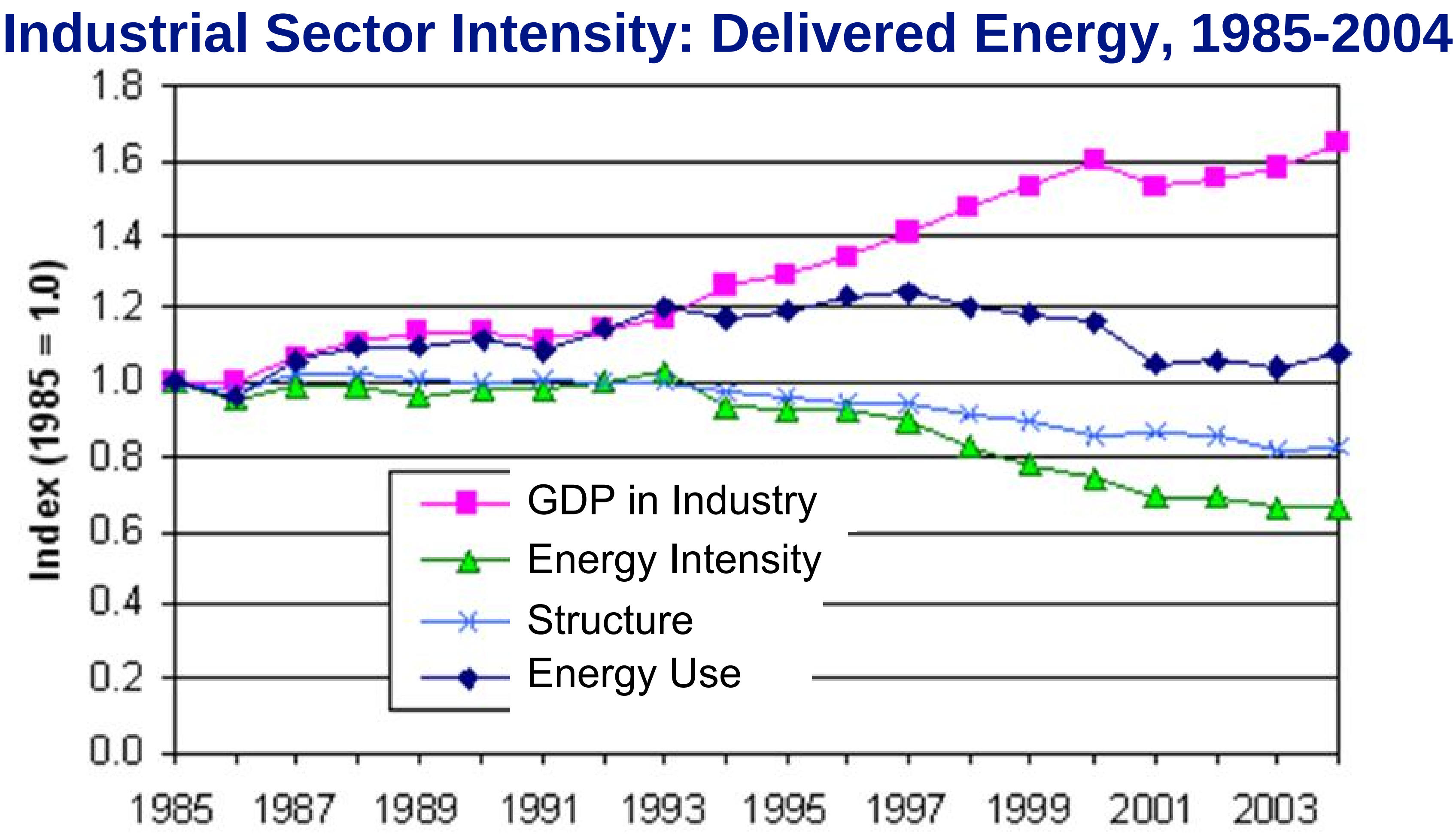
| | |
|---|---|
| Petroleum | 38.1% |
| Natural Gas | 33.3% |
| Electricity* | 13.5% |
| Coal and Coke | 8.5% |
| Renewable Energy | 6.6% |

* Excludes losses



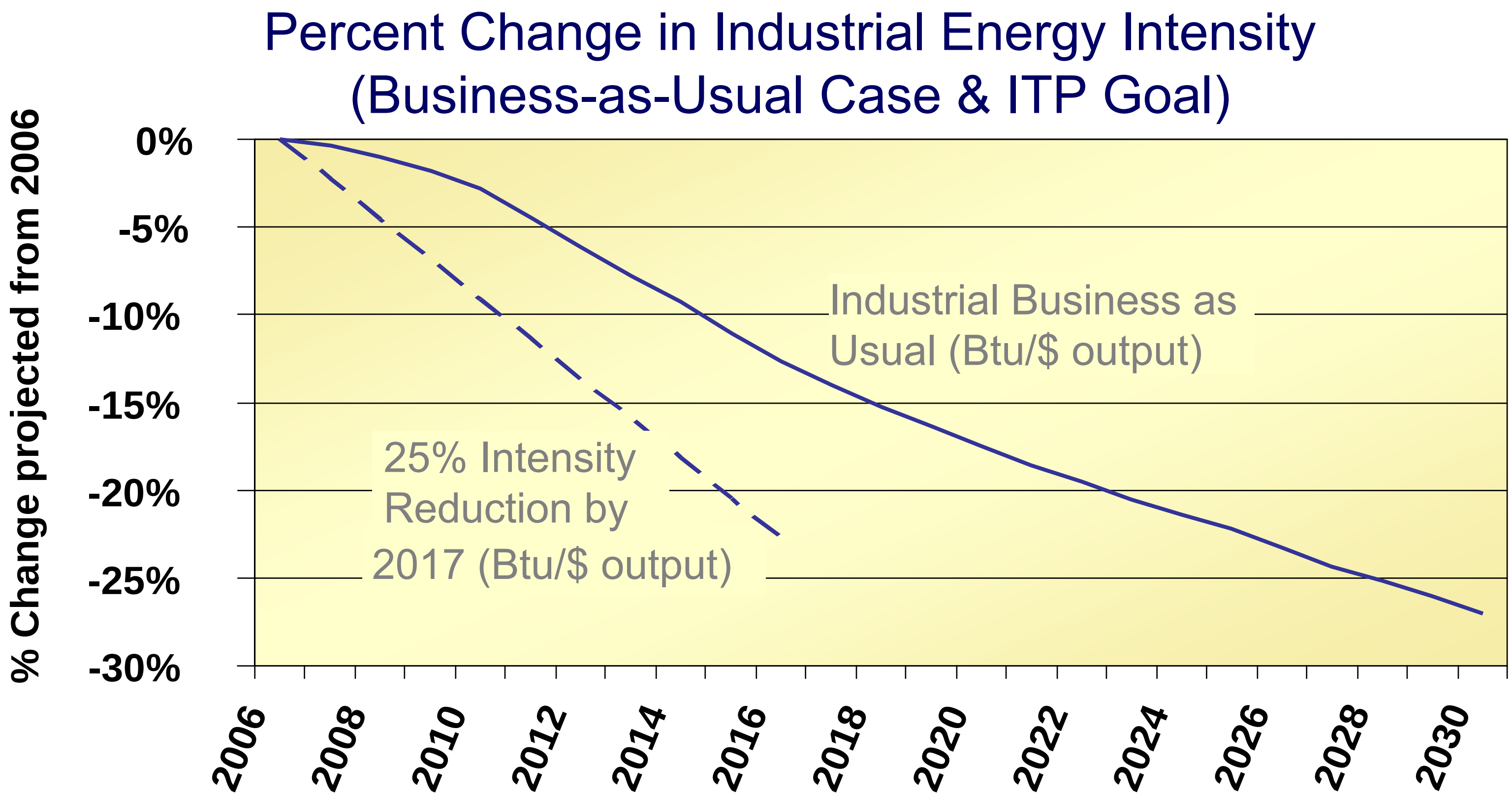

Source: DOE Energy Information Administration, 2006.

# U.S. Trends in Industrial Energy Intensity



# ITP's Goal

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




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

# Substantial Progress Is Achievable

- Existing technologies *with an attractive internal rate of return* can cut the growth in global energy demand by half or more within 15 years.

  -- *Curbing Global Energy Demand Growth*, McKinsey & Co., May 2007

- More than 10% of U.S. industry's energy use could be saved by more broadly adopting existing technologies that yield an internal rate of return greater than 10%.

  -- McKinsey, 2007

- Industries around the globe can cut $CO_2$ emissions 19 to 31% using *proven* technologies and practices.

  -- International Energy Agency, 2007

# ITP in Transition

- Budget rapidly declined between 2002-2007
  - “Industry Specific” line items below critical mass to be effective
  - Recent emphasis on near-term technical assistance (Save Energy Now)
  - R&D focus on “Crosscutting R&D” to maximize impact with a constrained budget
- FY 2008 - First year of ITP budget for several new areas
  - Energy Intensive Process R&D - 4 crosscutting technology platforms
  - Fuel and Feedstock Flexibility
  - Information Technology industry
  - Industrial Distributed Energy (formerly funded under DOE/OE)
  - Nanomanufacturing
- FY08 budget (~$50 million for R&D)
  - Focus limited to top priorities, particularly in industry-specific areas with very small budgets
  - Attempt to refill R&D pipeline
  - Solicitations in new areas

| ITP's Budget | FY 2007 | FY 2008 | FY 2009 |
|---|---|---|---|
| **Industries of the Future (Specific)** | ***16,585*** | ***11,245*** | ***11,392*** |
| Forest and Paper Products Industry | 2,888 | 1,738 | 1,448 |
| Steel Industry | 3,626 | 3,569 | 2,256 |
| Aluminum Industry | 2,273 | 1,737 | 2,139 |
| Metal Casting Industry | 986 | 192 | 973 |
| Chemicals Industry | 6,812 | 3,710 | 4,273 |
| SBIR/STTR | | 299 | 303 |
| **Industries of the Future (Crosscutting)** | ***39,178*** | ***53,163*** | ***50,727*** |
| Industrial Materials for the Future | 9,882 | 4,717 | 4,654 |
| Combustion | 2,366 | 641 | 583 |
| Sensors & Automation | 3,062 | 1,805 | 0 |
| Industrial Technical Assistance | 23,868 | 12,751 | 19,567 |
| Energy-Intensive Process R&D | | 7,186 | 14,846 |
| Fuel and Feedstock Flexibility | | 2,805 | 3,889 |
| Nanomanufacturing and Other Interagency MFG R&D | | 4,823 | 4,861 |
| Industrial Distributed Energy | | 14,467 | 1,498 |
| Energy Efficiency Information Technologies | | 2,948 | 0 |
| SBIR/STTR | | 1,020 | 829 |
| **Total** | **55,763** | **64,408** | **62,119** |

# Recent Elevation in Political Support for Industry

Energy Independence and Security Act (EISA) of 2007

- Highlighted and authorized funding for several industrial/manufacturing areas:

| Section | Title | Authorized Funding |
|---|---|---|
| 451 | Industrial Energy Efficiency | FY08 - $120 million; FY09-12 - $220 million annually |
| 452 | Energy-Intensive Industries Program | FY08 - $184 million; +$6 million each year from FY09-12 |
| 453 | Energy Efficiency for Data Center Buildings | No funding authorized |
| 471 | Energy Sustainability and Efficiency Grants and Loans for Institutions | FY09-13 - $250 million annually for grants<br>FY09-13 - $500 million annually for loan fund |
| 656 | Renewable Energy Innovation Manufacturing Partnership | FY08-13 - $25 million annually |

# Technology Delivery Products and Services

Save ENERGY Now

## Tools

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

## Information

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


## Standards

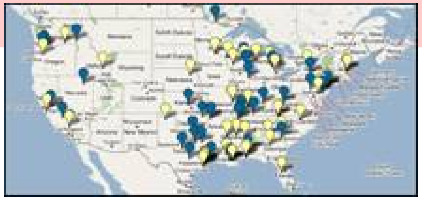
- Plant Certification

## Training

- Basic
- Advanced
- Qualified Specialist

## Assessments

- Energy Savings Assessments
- **Industrial Assessment Centers**

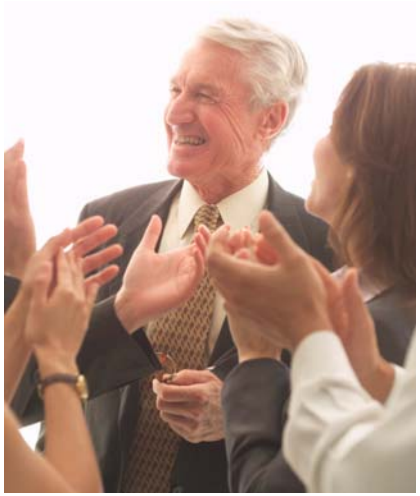


# DOE's Save Energy Now Leader Initiative

1. Companies pledge to adopt a goal to reduce energy intensity 25% or more over 10 years
   - Develop an energy intensity baseline
   - Develop an energy management plan
   - Designate an energy manager or leader
2. Take steps to reduce energy intensity and reduce carbon emissions
3. Report energy intensity data and achievements annually to DOE

# DOE Plans to Provide:

- Priority access to energy system assessments on multiple industrial systems and emerging advanced technologies
- Tailored assistance in developing the energy baseline and energy management plan, plus ongoing access to expert advice
- Waived fees for training workshops on financing options, advanced technology, energy management, software tools, etc.
- Easy access to proven, energy analysis tools, services, and other resources
- National, high-level recognition for pledge participation and subsequent achievements



Save ENERGY Now LEADER

# Save Energy Now Assessments

- 200 performed in 2006, 258 in 2007
  250 planned for 2008, 114 have been completed
- 3-day large plant assessment process:
  - Leadership by qualified expert
  - Plant selects system of focus (e.g., steam, process heating, pumps, compressed air, fans)
  - Plant staff trained on use of software tools
- Value of training component:
  - Prepares staff to play continuing role in assessments
  - Achieves strong staff buy-in for assessment results
  - Equips company to replicate assessments at sister plants

# Save Energy Now

## ESA and IAC Results as of 8/1/2008

**Identified Savings:**

1495 Plants Reporting

- 101 Trillion Btus Site
- 124 Trillion Btus Source
- $998 Million
- 8.3 Million Metric Tons $CO_2$

**Implemented Savings:**

882 Plants Reporting

- 23 Trillion Btu's Site
- 25 Trillion Btu's Source
- $154 Million
- 1.7 Million Metric Tons $CO_2$

# Save Energy Now Assessment Recognition Program

- Rewards companies that implement energy-saving technologies and practices identified through the assessments to achieve a high level of energy efficiency
- **Awards to date:**

  **66 Energy Champion Plants:**
  Saved > 250,000 MMBtu *or* 15% total energy use

  **112 Energy Saver Plants:**
  Saved > 75,000 MMBtu *or* 7.5% total energy use


**Companies include:**

- Owens Corning
- Dow Chemical
- General Motors
- General Electric
- Sunoco
- Coors/Ball Corp.
- Boise Cascade
- Goodyear
- US Steel
- Tyson Foods
- Honeywell
- JR Simplot

# Energy Management Standards & Certification

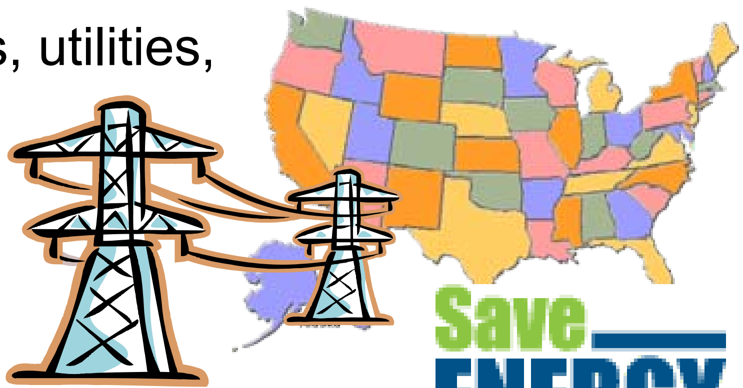
- Working with industry to facilitate development of recognized industrial energy management standard and certification program to:
  - Engage all employees in technically sound and sustainable process for improving energy efficiency (i.e., change corporate culture).
  - Make energy efficiency improvements part of existing industrial management systems (e.g., ISO, Six Sigma).
  - Help companies gain market value for accomplishments in energy efficiency.
  - Provide way for companies to show they are part of the solution to climate change.
  - Pilot Program at 5 plants underway

ANSI
ANSI Accredited Certification Program

CERTIFIED

# Partnerships Key to Implementation

DOE is developing partnerships with states, utilities, regional organizations, academia, trade groups, and private companies



- Transfer energy-efficient technologies to the industrial market
- Reduce carbon emissions through energy efficiency

Save ENERGY Now

### Government Partners

- NIST, U.S. Dept. of Commerce, Manufacturing Extension Partnership
- Environmental Protection Agency (ENERGY STAR, Climate Leader, and Green Supplier Network)
- State governments and organizations

### Private Partners

- National Assoc. of Manufacturers and other associations
- Green Grid
- Utilities
- Supply chains

# State Save Energy Now Funding Opportunity

Closes October 16, 2008

10 – 16 awards in 2009 Each award to $300K per/year for 3 years

- Development and delivery of Industrial Energy Efficiency programs implemented at the local, state and/or regional level
- Robust: Include IACs, RACs, other ITP resources, other state or regional energy efficiency/industrial groups, utilities, academia
- Employ existing ITP areas of focus or be innovative as long as industrial energy efficiency is the goal
  - Define outreach and marketing strategy
  - Define results and how measured
  - Support SEN Leaders (25% energy intensity reduction in 10 year target)
- Assessments, training, technology demonstrations, participation in ANSI Plant Cert. pilot are all options

# ITP States Website

Repository of state-level industrial resources and information, including

- ✓ Economic data, indicators, and activity
- ✓ ESAs, IACs, events and training, research and development
- ✓ ITP project successes
- ✓ Contacts
- ✓ State incentives database

- ● SEN Assessments (40)
- ● IAC Assessments (23)
- ● R&D (9)


www2.eere.energy.gov/industry/about/state_activities/main_map.asp

# Industrial Distributed Energy

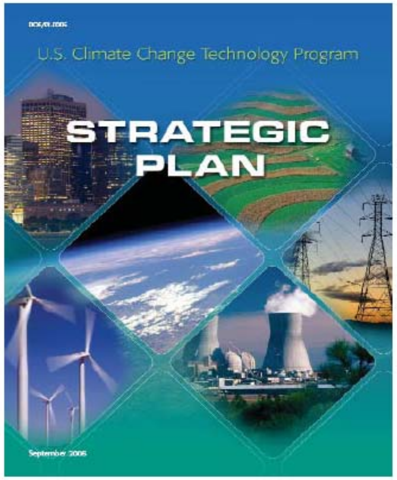
# and

# Combined Heat and Power

# Industrial Distributed Energy Activities: Increase Energy Productivity

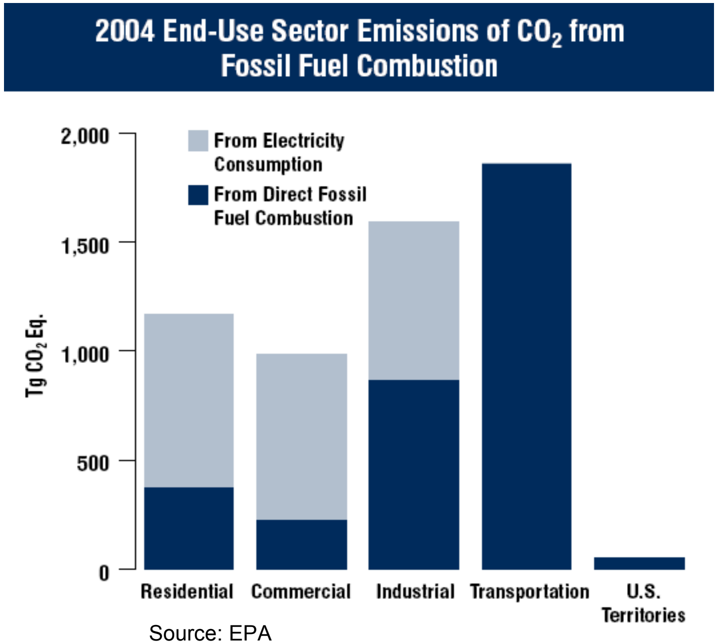
- ITP’s goal is to spur the widespread commercial deployment of CHP and other distributed energy solutions (e.g., advanced reciprocating engines) throughout the nation
  - Reduce energy intensity
  - Reduce greenhouse gas emissions
- 2020 Goal (2006 Baseline):
  - 33 MMT $CO_2$/yr (9 MMTCE/yr) savings
  - 0.3 Quad annual energy savings
  - Corresponds to ~7 GW of incremental CHP in industry from “business as usual”

# Industrial Distributed Energy: Opportunity




"The industrial sector presents numerous opportunities for advanced technologies to make significant contributions to reductions in $CO_2$ emissions to the Earth's atmosphere."

*U.S. Climate Change Technology Strategic Plan* – Office of Science and Technology Policy




Source: EPA

*CHP and other DG technologies offer a sizable near term option for large energy efficiency improvements and corresponding $CO_2$ reductions*

# ITP’s Vision for Industrial Distributed Energy

- CHP and other distributed energy technologies are well recognized and broadly deployed in industrial, commercial, and institutional markets as the best means to simultaneously
  - Reduce GHG emissions
  - Promote industry use of secure domestic and renewable energy sources
  - Improve energy efficiency by eliminating wasted energy streams
  - Reduce risk and exposure to high and volatile energy prices
  - Maximize competitiveness of U.S. industry

# ITP's Role in Industrial Distributed Energy

- Federal leader of the implementation of innovative technology solutions for CHP, advanced reciprocating engines, and other DG technologies
- Independent, objective, and authoritative voice on industrial technology and the significant impact it has on efficiency and greenhouse gas emissions
- Leader and primary catalyst for partnerships to eliminate institutional and market barriers to DG systems
- Supporter of applied technology development to improve efficiency, reduce waste heat, and utilize alternative fuels

***Key Programmatic Metrics for Success***

- $CO_2$ Reductions
- Energy savings
- Calculated on a primary source basis

***Contributions to EERE Goals***

- Traditionally fueled Industrial/Institutional and Commercial CHP
- Renewably fueled CHP
- "Recycled" waste energy

# Industrial Distributed Energy Portfolio: Focus Areas

- ***Technology Development***
  - Obtain maximum energy efficiency from distributed energy systems using traditional or non-traditional fuels, and develop approaches to capture and use waste energy streams
- ***Technology Validation***
  - Establish the performance of DG systems in targeted applications
- ***Market Transformation***
  - Provide users with the tools to evaluate the potential of DG and enable implementation of DG systems in industrial applications
- ***Technical Support***
  - Establish a sound technical basis for the ITP DG initiative, provide updated market analyses, and enable coordination with domestic and international stakeholders

# Industrial Distributed Energy: Current Priorities

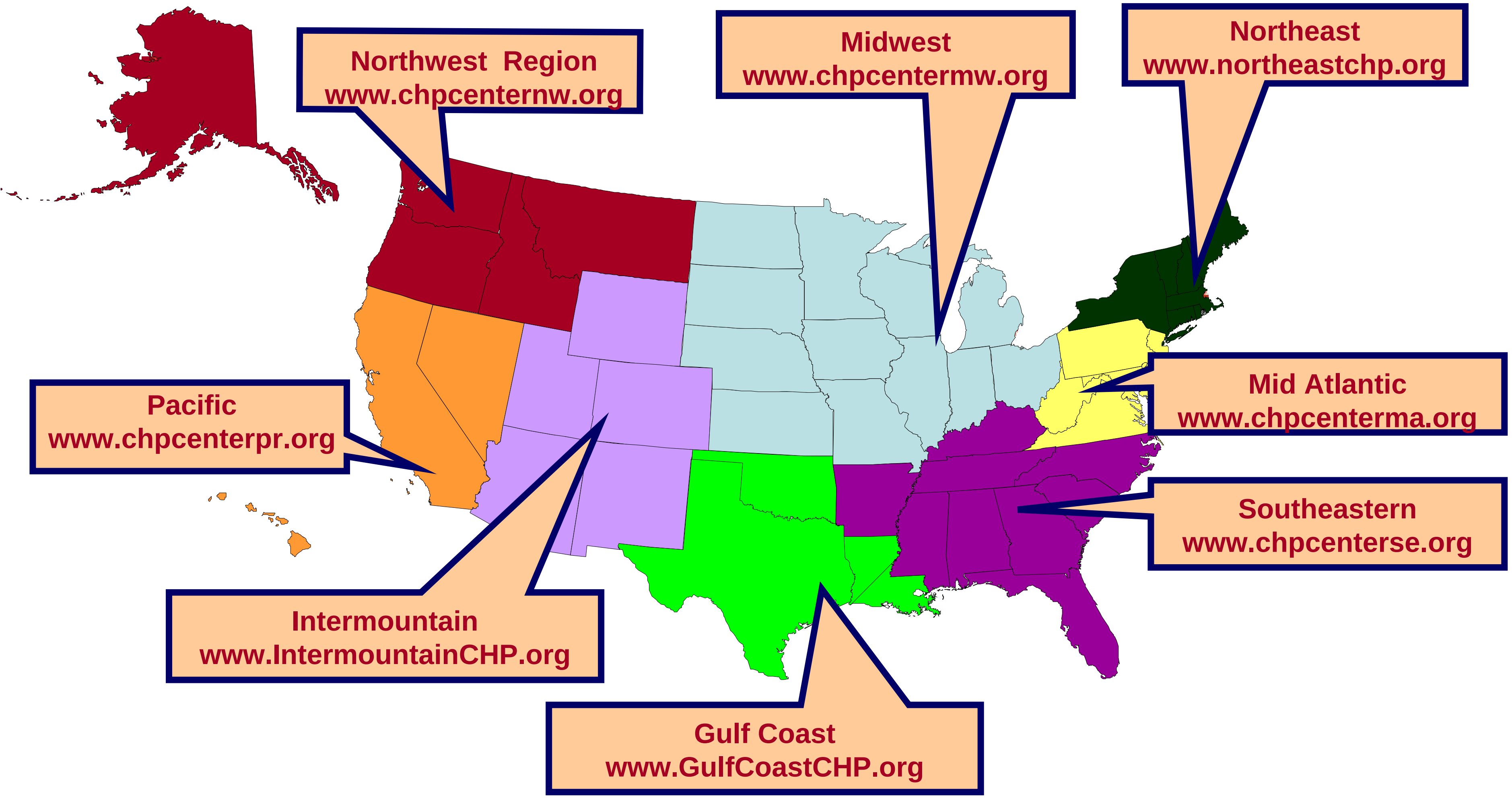
- Restart stationary engine R&D with Caterpillar, Cummins and Waukesha
  - Include alternates to natural gas as fuel
  - Continue to use the capabilities of Argonne National Laboratory
- Initiate R&D on technologies to improve cost-effectiveness of CHP
- Support near-term demonstrations of CHP in target markets
  - Frito-Lay, supported with FY 2007 funds
  - IBM/UTC Data Center, supported with 2008 funds
  - Additional opportunities as identified in solicitation
- Continue to support activities of the CHP Regional Application Centers

# Combined Heat and Power System at Frito Lay Plant

- System will take facility off the electric grid
- GHG emissions cut by > 5%
- CHP System
  - 4.6 MW Solar Taurus 50 Gas Turbine with SCR for NOx Control
  - Provides 100% electricity needs and 50% of site steam needs
- Site in Killingly, Connecticut
  - 400 employees
  - Processes 250,000 lb/day of corn and potatoes (each) for chips
- Scheduled groundbreaking 4th quarter FY08

# CHP Regional Application Centers in ITP

# CHP Regional Application Centers



# RAC Activities

- Planning and Analysis
- Collaboration
- Information Development
- Outreach
- Education
- Technical Assistance/Project Support
- Track and Analyze

# RACs and the IACs

- RACs are co-located with 5 IACs
  - Midwest: University of Illinois, Chicago
  - Northeast: University of Massachusetts
  - Pacific: San Diego State University
  - Southeast: North Carolina State University, Mississippi State University

# CHP Capacity by RAC Region

| RAC Region | # Sites | Capacity (MW) |
|---|---|---|
| Gulf Coast | 224 | 25,769.30 |
| Intermountain | 87 | 1684.1 |
| Mid-Atlantic | 389 | 10,546.70 |
| Midwest | 507 | 10,565.20 |
| New England | 18 | 98.1 |
| Northeast | 681 | 9,524.80 |
| Northwest | 211 | 4,529.60 |
| Pacific | 986 | 10,097.80 |
| Southwest | 279 | 12,421.20 |
| **Total** | **3,382** | **85,236.70** |

# Save ENERGY Now