



**MAG Greening Water and
Wastewater Infrastructure
Workshop, Phoenix AZ**

Patti Case

US DOE Clean Energy Center,
Intermountain Region

- Goals
 - Resources for you/your operations
 - Provide information that we hope you will pass along to your “clients” - Commercial and Industrial End Users
- Path
 - Just a bit about DOE overall then “drill down”
 - Energy Efficiency and Renewable Energy
 - Industrial Technologies Program
 - Clean Energy Centers –Intermountain in particular
 - Other Technical Assistance

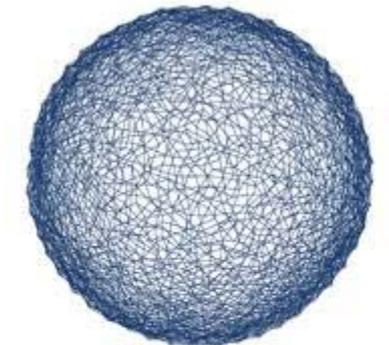
- A **Huge** entity with a broad mission
 - Science & Technology
 - Energy Sources
 - Energy Efficiency
 - Environment
 - Information/prices & trends
 - National Security
 - Safety and Health

- Civilian Radioactive Waste management
- Electricity Delivery and Energy Resources
- Energy Efficiency and Renewable Energy
- Environmental Management
- Fossil Energy
- Legacy Management
- Nuclear Energy
- Science

- Biomass
- Buildings
- Federal Energy Management
- Geothermal
- Hydrogen & Fuel Cells
- Industry
- Solar
- Vehicles
- Weatherization and Intergovernmental
- Wind & Hydro Power

Global Energy Issues in 2009

- Economic downturn
- Uncertain demand for products
- U.S./Worldwide Stimulus activities
- Energy price volatility
- International climate change negotiations
- New energy/climate legislation/policy



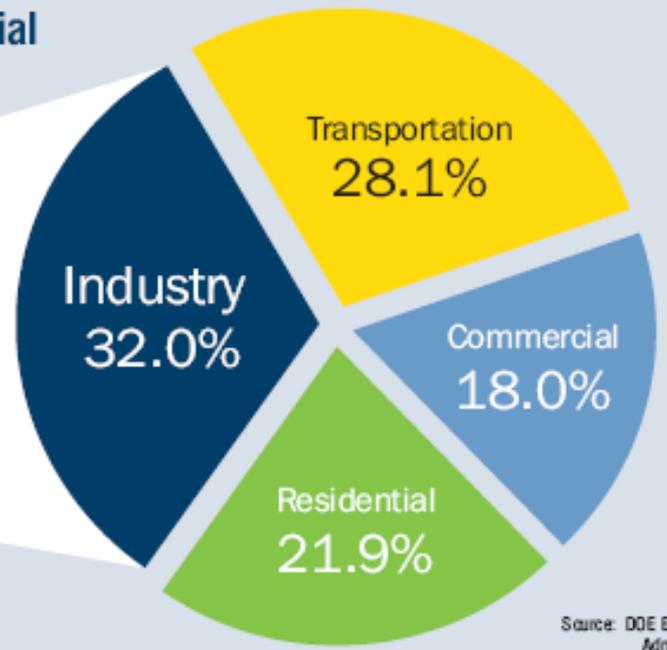
COP15
COPENHAGEN
UNITED NATIONS CLIMATE CHANGE CONFERENCE 2009

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%

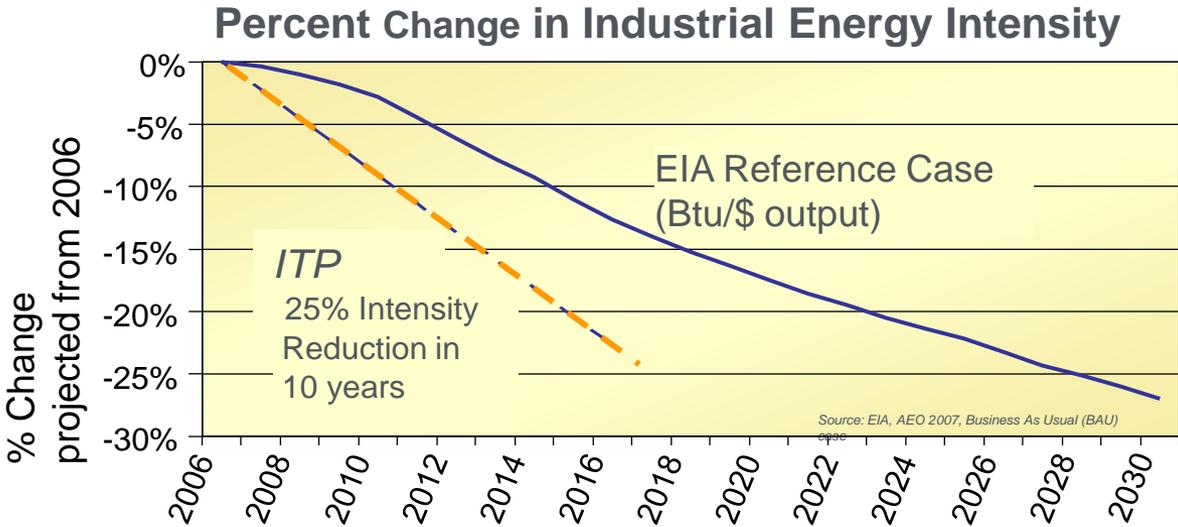
* Excludes losses



Source: DOE Energy Information Administration, 2008.

ITP Strategic Objectives

- Reduce industrial energy intensity by 25% in 10 years
- Establish the U.S. as the Global Leader in Energy Management



Energy Efficiency R&D

Develop cross-cutting technologies that address the top energy savings opportunities across industry



Save
ENERGY
Now



Technology Delivery

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

12% Industry-Specific

R&D addressing top priorities in America's most energy-intensive industries, incl. chemicals, steel, and forest products



32% Industrial Technical Assistance

Helping plants save energy today using efficient energy management practices and efficient new technologies



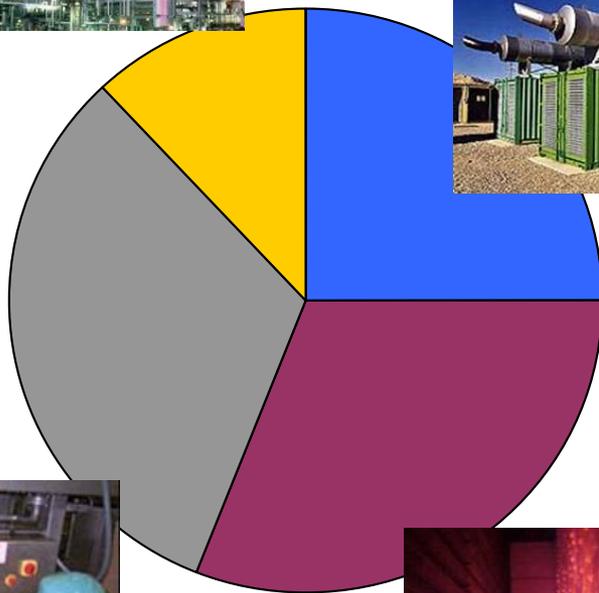
25% Industrial Distributed Energy

Activities to spur widespread commercial use of CHP and other distributed generation solutions



31% Other Crosscut

R&D to develop technologies applicable to multiple industrial subsectors



- **Recovery Act Funding Solicitation: CHP, District Energy, Waste Heat Recovery, and Ind. EE**
 - < \$200 Million Available
 - Received 367 Applications requesting \$3.8 Billion Federal Funds for \$9 .2 Billion total project investment (25 X more than available)
 - 9 Projects Selected Include: CHP, Waste Heat, Landfill gas, Industrial Energy Efficiency
- **DOE ITP CHP Demonstration Solicitation: Closed July 21,2009**

Top Initiative: Save Energy Now LEADER

- Voluntarily pledge to reduce energy intensity by 25% or more over 10 years
- Make continuous improvements in energy efficiency and carbon reduction as part of robust business strategy
- Gain enhanced access to enabling resources: tailored technical assistance, training, assessments, and more
- Receive high-level recognition for participation and achievements



Reduces energy costs and carbon emissions today

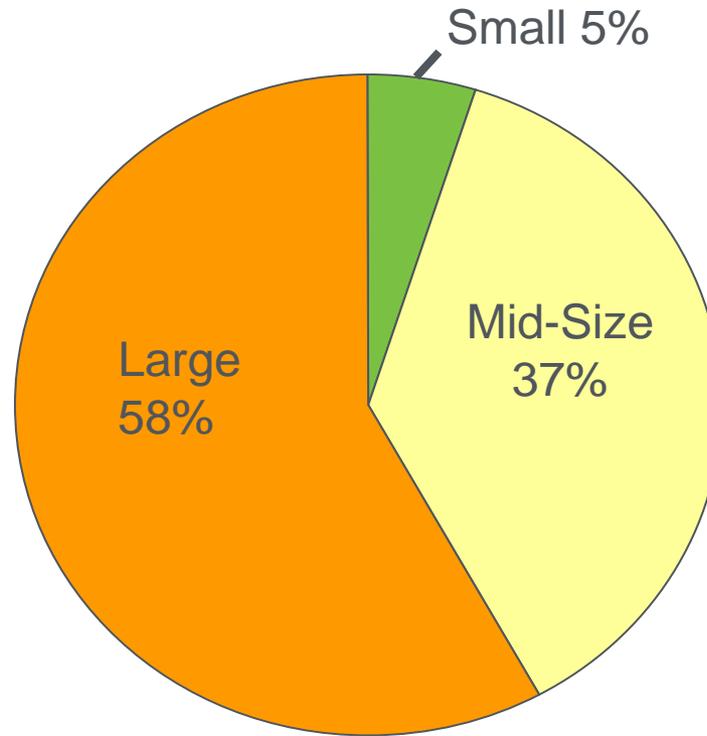
Meets EPA Act 2005 requirement for voluntary industry commitments to reduce energy intensity (Section 106)

A 25% reduction in industrial energy intensity is equal to the total energy consumed in the State of California in all sectors each year— 8.4 quads annually

It's all about producing more with the energy used.

4,014 large plants use
58% of the energy

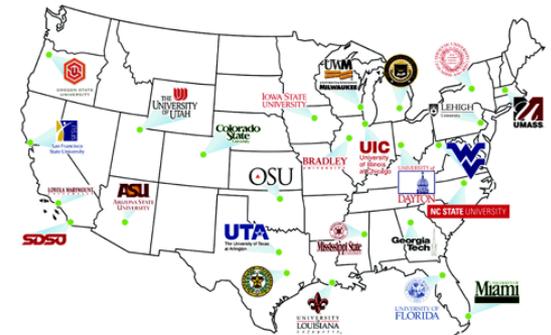
*Energy Saving
Assessments (System
focused)*



*Industrial Assessment
Centers (IAC)*

*Cross-Cutting Energy
Assessments*

**Save
ENERGY
Now**



Total Plants Assessed:	2,098
Identified Cost Savings:	\$1.2 billion
Identified Energy Savings:	134 trillion Btu (NG)
Identified CO ₂ Savings:	10.5 million MT

Generating electricity and heat from a single source, typically at or near the place where it is used.

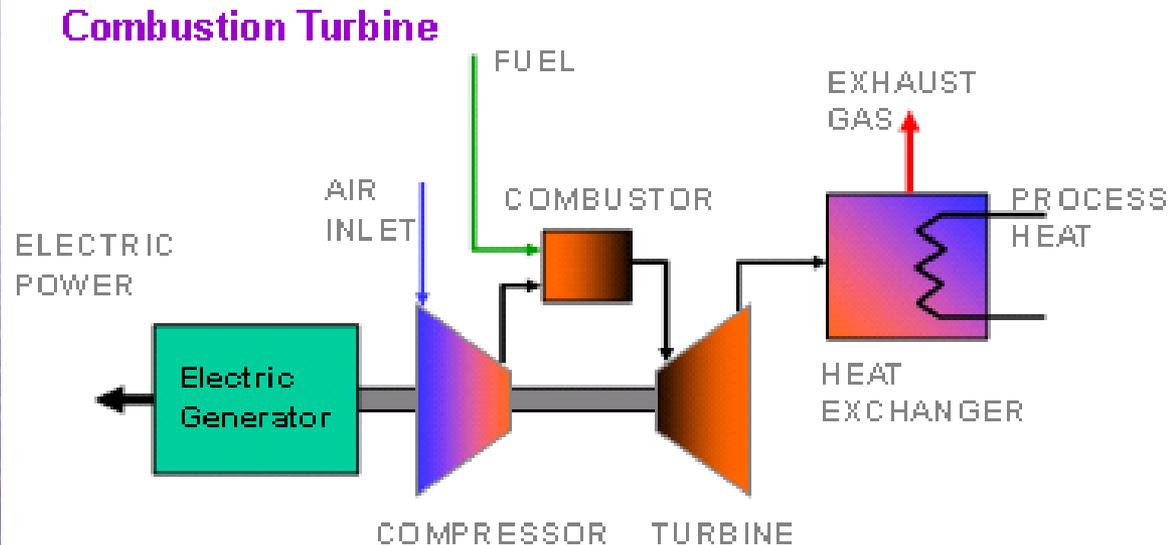
Significantly more efficient than generating each of these separately.

The average power plant in the U.S. is 33% efficient, and the average overall efficiency of generating electricity and heat by conventional systems is around 51%.

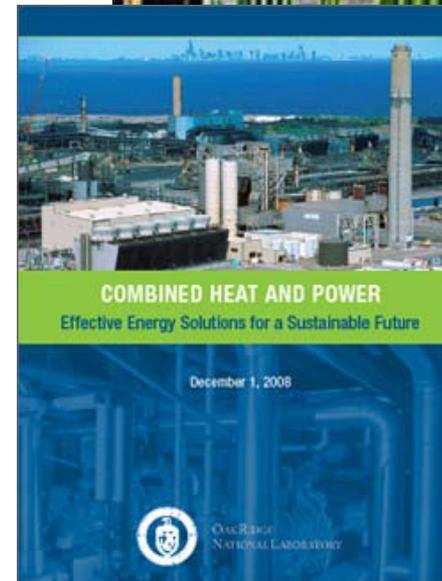
CHP units are often more than 80% efficient.

CHP is sometimes called "energy recycling" because the same energy is used twice - once for electrical energy and once for thermal energy

Schematic of a CHP System



- CHP is recognized as the best means to *simultaneously*
 - Reduce GHG emissions
 - Promote use of secure domestic and renewable energy sources
 - Reduce exposure to energy price hikes and volatility
- ITP activities include
 - Facilitating deployment and addressing barriers
 - Serving as an independent, credible voice on applications and benefits
 - Conducting R&D to improve efficiency, lower costs, and extend applications

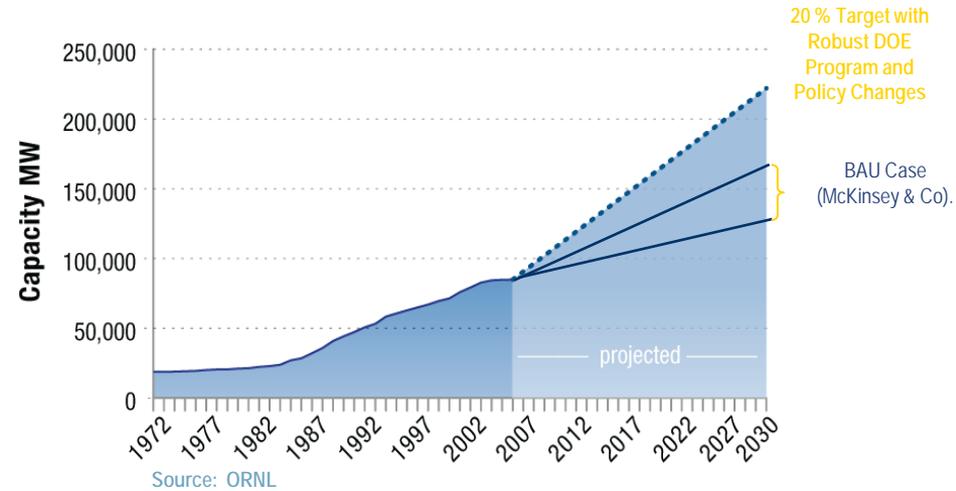


CHP offers a sizable near-term option for large energy efficiency improvements and CO₂ reduction

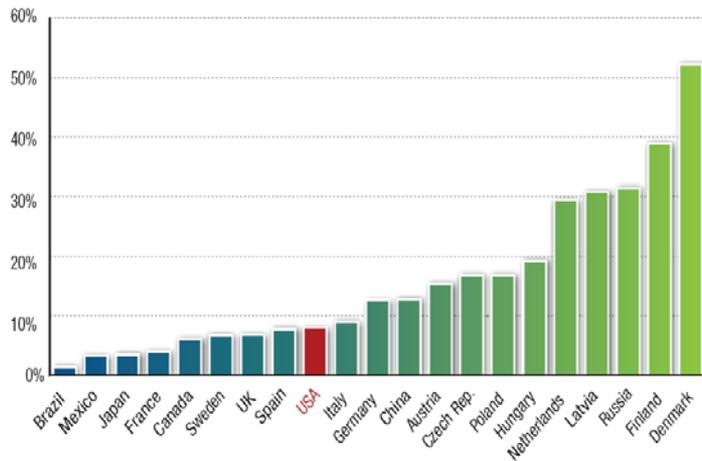
Source: EPA 14

CHP - 20% of US Generating Capacity in 2030

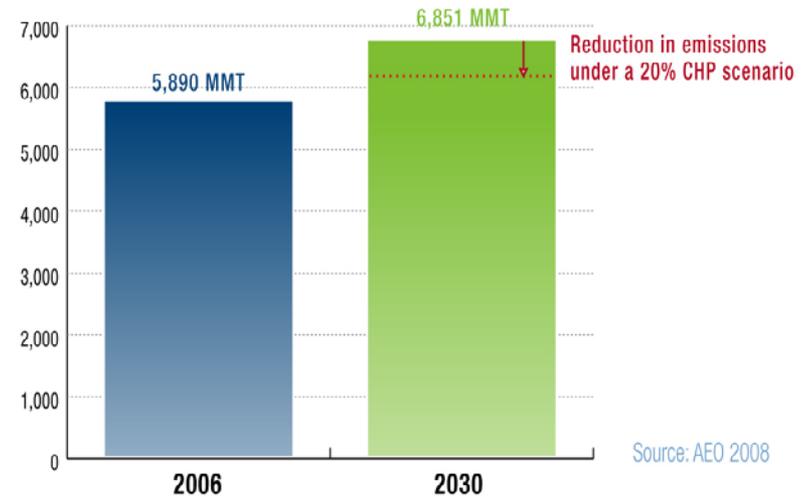
CHP	2006	2030 Target
Total Electricity Generating Capacity	85 GW (9% of current capacity)	240.9 GW (20% of projected capacity)
Annual Energy Savings	1.9 Quads	5.3 Quads
Annual CO ₂ Reduction	248 MMT	848 MMT
Number of Car Equivalents Taken Off Road	45 million	154 million



CHP in a Global Context – 20% Capacity Goal is Reachable



Carbon Dioxide Emissions 2006 and 2030 (MMT)



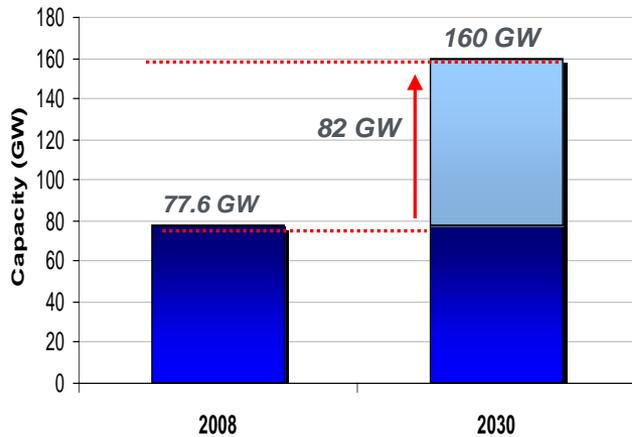
2030 Goal: Aggressive Growth in All Markets

Large CHP >20 MW

Existing Industrial Market

- Improved performance
- Utilize new fuels and waste streams
- Overcome external barriers

Over 1,600 new systems

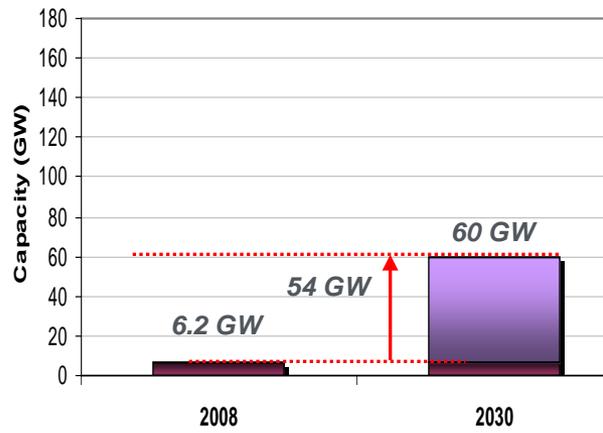


Mid CHP 1 MW to 20 MW

Fast-Growth Market

- Technology for new applications
- Packaged systems
- Demonstrations to make the business case

Over 10,000 new systems

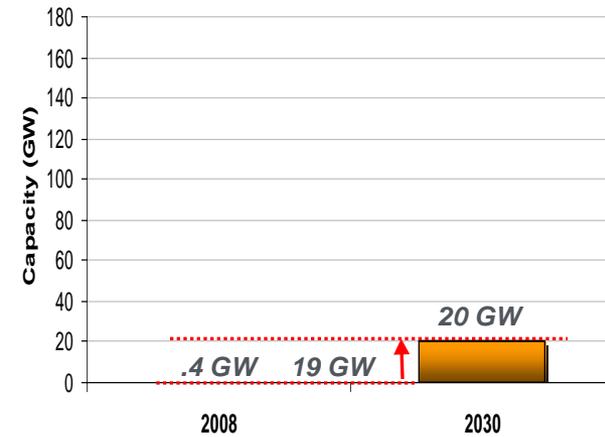


Small CHP <1 MW

Emerging Market

- New systems and technologies
- Smart Grid and 'green' consumers
- Build distribution network

Over 50,000 new systems



Market sectors include CHP, District Energy, and Waste Energy Recovery applications

Three Key Investment Areas

1. Technology Research and Development

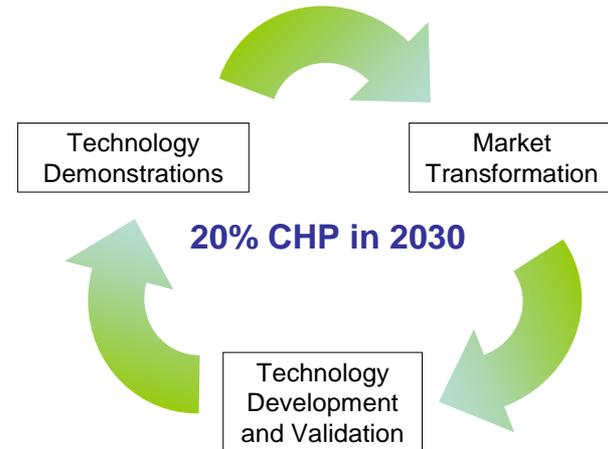
- *Alternative fuels and low-value waste heat*
- *Maximize utilization of waste streams in large industrial sector*
- *Small and mid-size systems for new markets*
- *Improve technical performance of CHP*
 - *Operating costs and installed costs*
 - *Efficiency*
 - *Reliability*
 - *Compliance with Emissions Regulations*

2. Technology Demonstrations

- *Innovative market applications*
- *Project development best practices*
- *Value to users, utilities and public*
- *Quantify CO2 reductions and energy savings*
- *Reduce technical risk*
- *Showcase systems*

3. Market Transformation

- *Targeted End-User Education and Outreach*
- *Coordination with Utilities on Technical and Regulatory Issues*
- *Regulatory/Policy Supportive Information and Analysis*
- *Accelerate the CHP Investment Decisions*
- *Demonstrate Role in GHG Reduction*



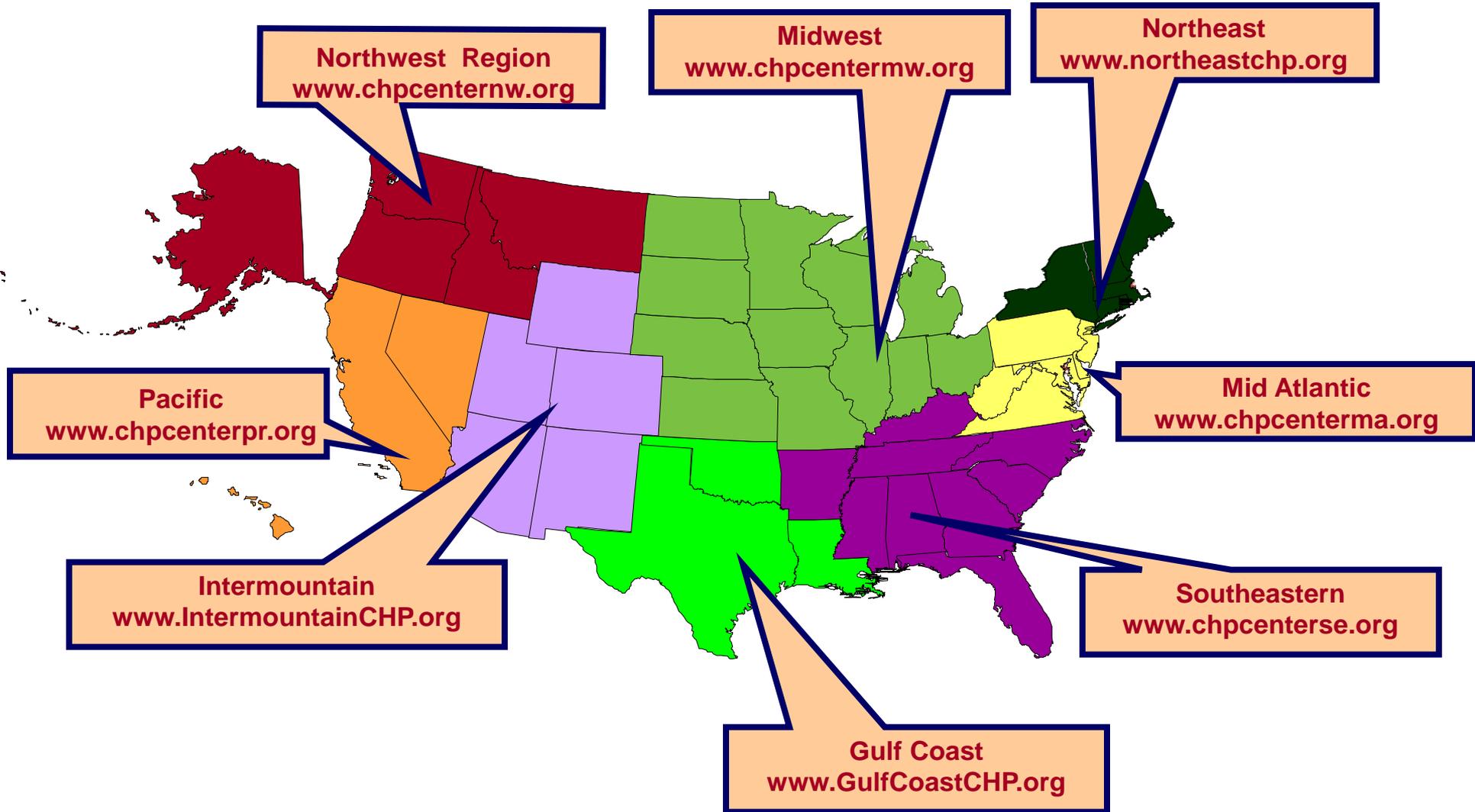
*Accelerate the project
develop/investment decision process
and broaden range of users*

*RACs lead DOE's CHP
outreach efforts and
establish DOE RAC
brand through
coordinated planning
and execution of
regional specific
activities*

US DOE's Regional Centers to Lead Deployment and Market Transformation by

- Educating regional players on benefits to remove barriers and reduce perceived risk
 - End-Users
 - Policy Makers
 - Regulators

US DOE Clean Energy Application Centers



- ETC Group, based in Salt Lake City, Utah
- Southwest Energy Efficiency Project (SWEET) based in Boulder Colorado
- States of AZ, CO, NM, UT, and WY
- Technology Focus
 - Combined Heat and Power
 - Waste Heat Use/Recovery
 - District Energy

- Market assessment
- Education and outreach
- Coalition building
- Project support and facilitation
- Policy review and reform
- www.intermountainchp.org

- CHP/Waste Heat projects
 - Technical Assistance to Identify and Quantify Savings
 - Project/proposal review
 - Case Studies
 - End User Workshops
 - Policy and Regulator Education
 - Utility Rate and Interconnection Issues
 - Permitting Issues
 - etc....

- Wastewater treatment plants, with wastewater flows of at least 1 million gallons per day (MGD)
 - Municipal treatment plants*
 - At least 4,290 plants with 1 MGD or greater
 - Over 1,700 of these have anaerobic digesters, and over 1,500 are not currently utilizing digester gas
 - Paybacks in the 2-4 year range can be attained when investing in CHP and already possessing a digester
- CHP units range from \$1,500-6,000/kW installed

Case Study

Ina Road WWT Plant

- Tucson, Arizona
- 25 million gallons/day (MGD)
- ELECTRICITY COST FROM CHP: \$0.047/kWh
- ANNUAL SAVINGS: \$1,260,000
- EQUIPMENT: 7 650-kW Waukesha engines with
- heat recovery, 950-ton absorption chiller
- FUEL: Digester gas, natural gas, and propane for backup
- CHP CAPACITY: 3,300 kW (1,100 kW from digester, 1,650 kW from natural gas)
- USE OF THERMAL ENERGY: HVAC, chilled
- water, domestic hot water, heating the digester
- CHP EFFICIENCY: 65%
- CHP IN OPERATION SINCE: 1977
- FUTURE PLANS: Expand CHP to 6-8 MW

Digester Gas

- 350,000 cubic feet/day (current)
- 1,000,000 cubic feet per day (future)
- 600 BTU per cubic foot
- 60% methane
- 40.1% Carbon Dioxide
- 0.23% Nitrogen
- 15 ppm Hydrogen Sulfide
- 0.025% Siloxanes (increasing)

- Seven 650-kW Waukesha engines



WWT and Landfill Workshops (see www.intermountain.chp.org)

Denver – November, 2007

Salt Lake City - August , 2005

Typical Agenda

Market opportunities

CHP Systems

Fuel Cleaning and Conditioning

Electrical Rates

Case Studies

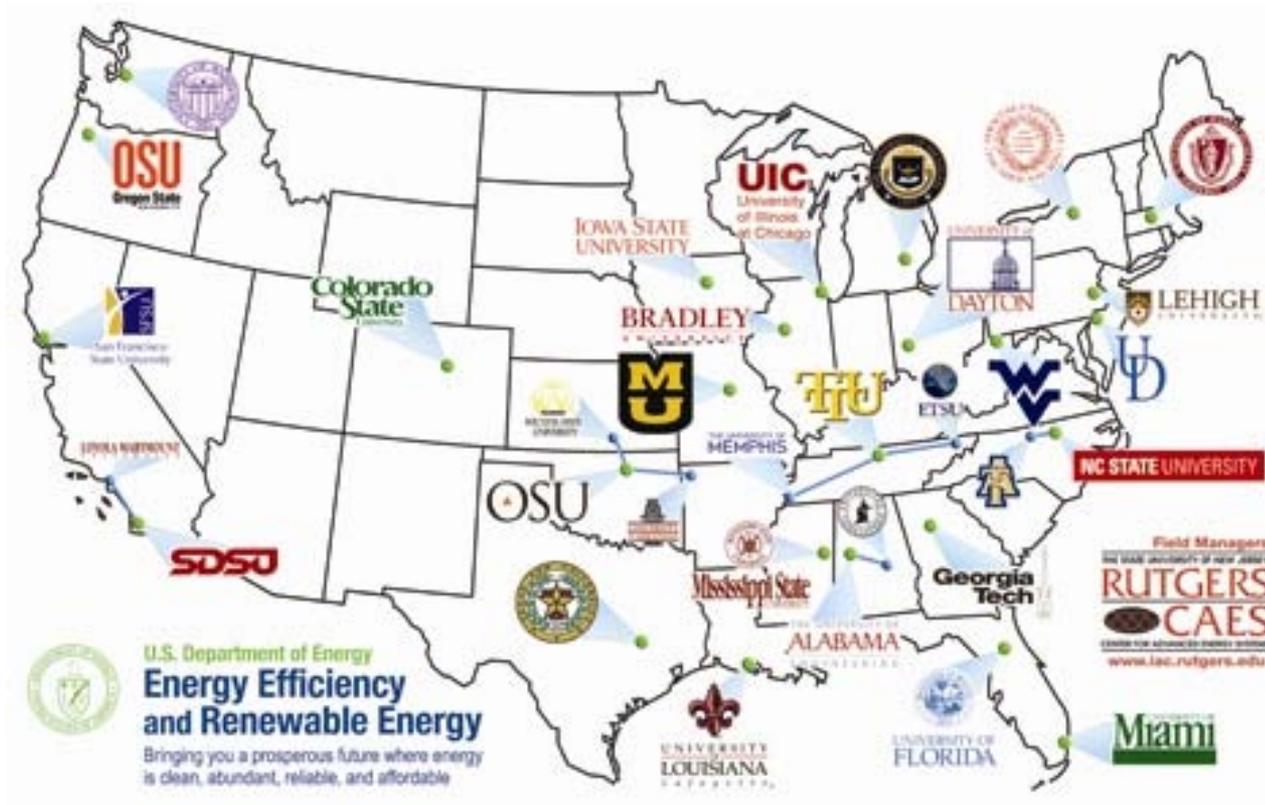
Plant Operating Issues

Energy Utilization Issues

Tours

- CHP: Opportunities at Wastewater Treatment Facilities
- EPA CHP Partnership Webinar
- January 21, 2010 1:00 to 2:30 MST
 - Will address opportunities and challenges of implementing CHP at WWTFs.
 - EPA's CHP Partnership's efforts in WWTF and plans going forward
 - two case studies of successful CHP systems at WWTF
 - Register at: <https://www2.gotomeeting.com/register/578096627>
 - EPA CHP Partnership www.epa.gov/chp/

Industrial Assessment Centers



- Energy, waste, and productivity assessments to small and mid-sized manufacturers
- Assistance provided by upper-level engineering students

- Director: Dr. Douglas C. Hittle
- Phone: (970) 491-8617
- Fax: (970) 491-3827
- E-mail: hittle@engr.colostate.edu

- Assistant Director: Mr. Michael Kostrzewa
- Phone: (970) 491-7709
- E-mail: michael@engr.colostate.edu

- Address:
- Department of Mechanical Engineering
- Colorado State University
- Fort Collins, CO 80523-1374
- IAC Office Phone: (970) 491-7709

- <http://www.engr.colostate.edu/IAC/>

- 2010 Industrial Utility Webinar Series – Financial Mechanisms and Incentives
- Wednesday, March 10, 2010 12:00 PM - 2:00 PM EST
- This session will focus on various financial mechanisms and incentives which allow industrial energy consumers to implement energy efficiency projects. The Webinar topics may include the energy service company (ESCO) model, state incentives, public benefit funds, and utility rebates, along with other mechanisms and incentives. Utilities and industrial energy customers can share perspectives on which financial programs work best and why.
- <http://www1.eere.energy.gov/industry/>
- Events Section

Intermountain Clean Energy Application Center

www.intermountainCHP.org

ETC Group

Patti Case

plcase@etcgrp.com (801)278-1927

Southwest Energy Efficiency Project

Christine Brinker

cbrinker@swenergy.org (720) 939-8333

Thomas Broderick

tbroderick@swenergy.org (928) 527-8036