A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

# Demand-Side Management Resulting in Emissions Reductions and SIP Credit

**Adam Chambers**
**National Renewable Energy Laboratory**

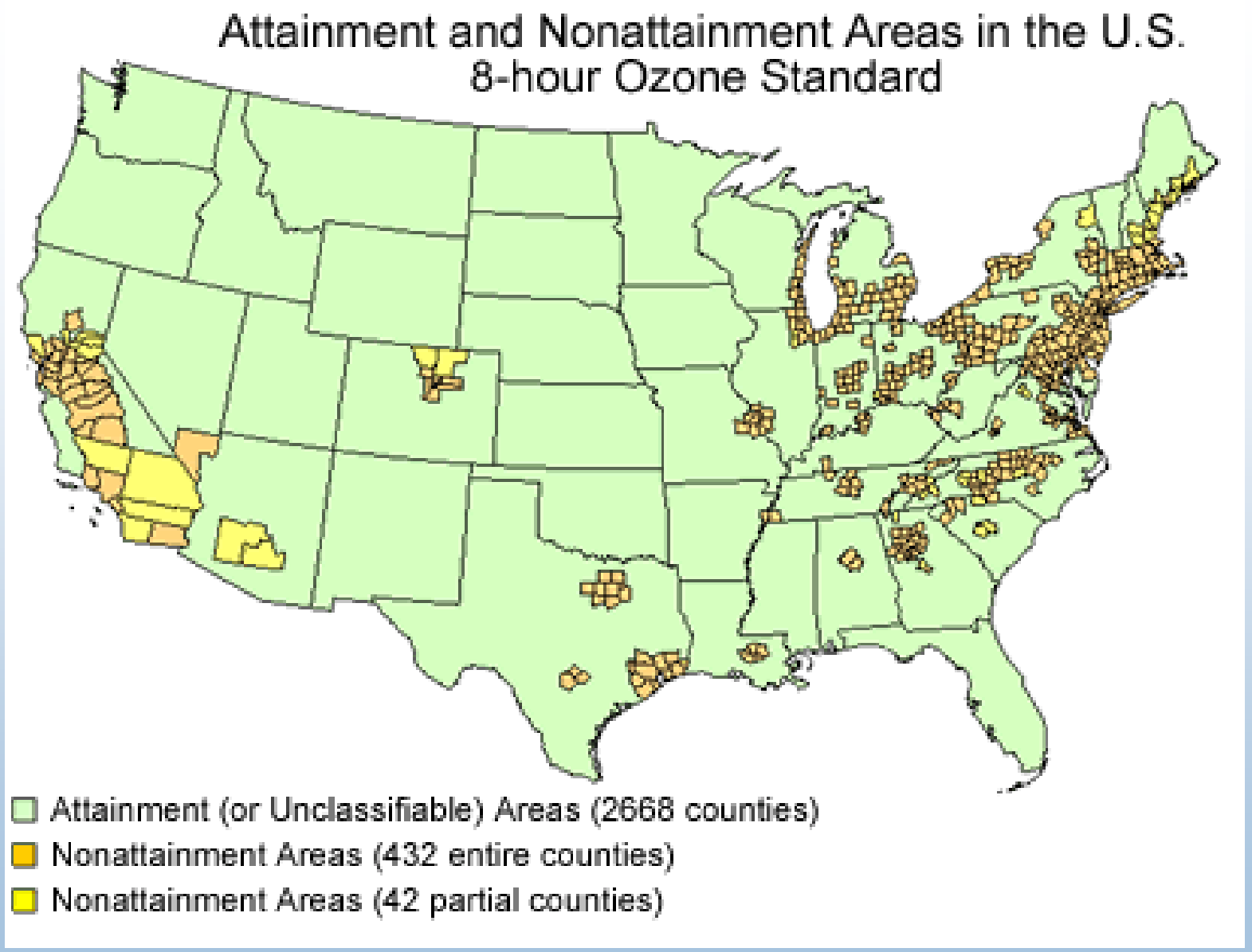
## Performance Contracting Conference

**New Orleans, LA**

**July 28, 2005**

# Presentation Take Home

- Energy Efficiency and Renewable Energy both provide an opportunity for air pollution emission reductions – also GHGs
- In a grid-connected environment, the benefits of EERE can be quantified with enough certainty to satisfy regulatory authorities – USEPA
- Future of EERE in displacing emissions
- It is cheaper to save electricity than to make it! – energy efficiency focus




**Over 180 million people live in O3 non-attainment areas**

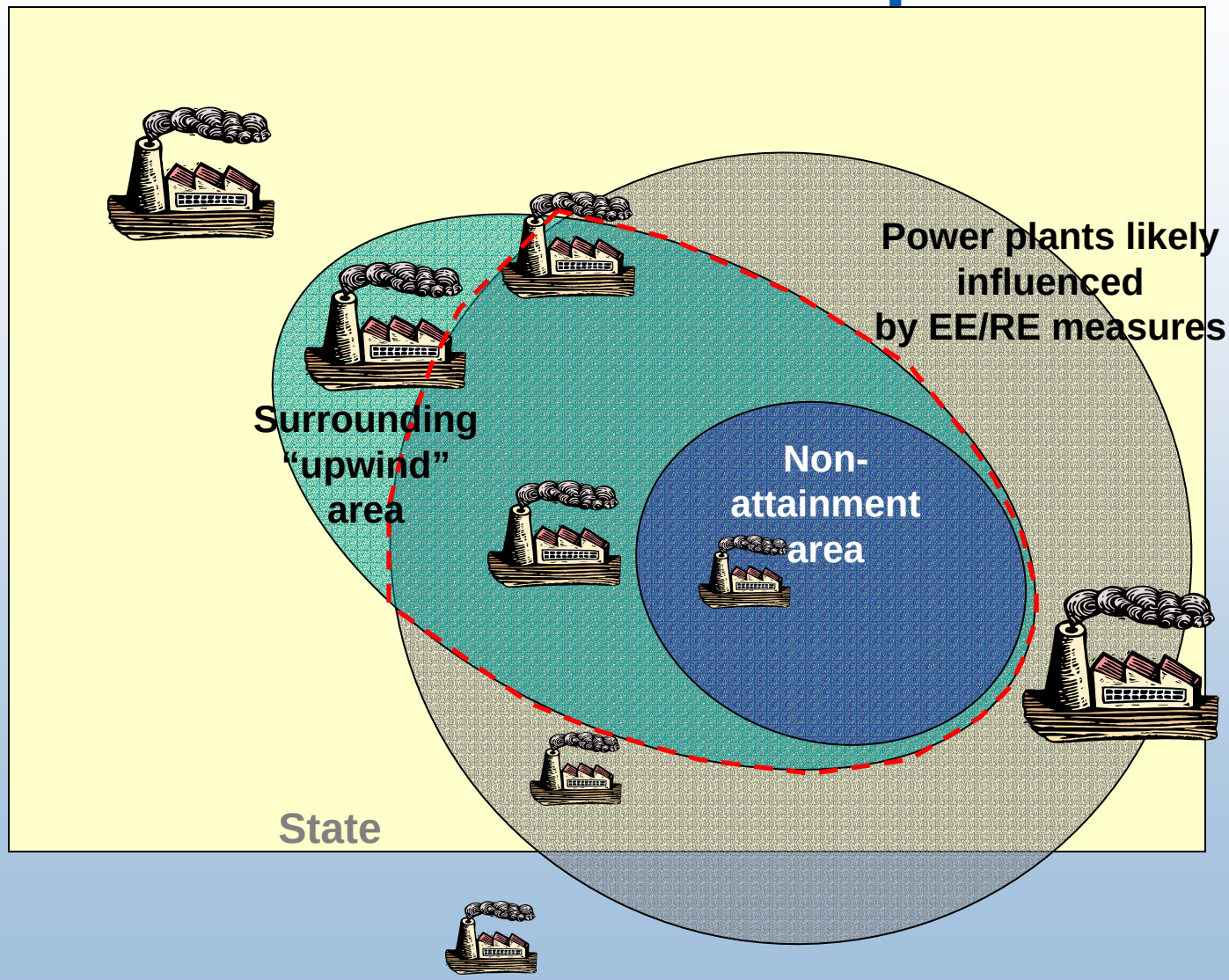
# EE/RE to Meet Air Quality Standards

- **Tighter 8-Hour Ozone and PM2.5 Standards**
  - easily implemented "control" measures have already been implemented – 1-hour standard
  - more non-attainment areas
  - additional reductions required

- **Benefits of EE/RE**
  - multipollutant/multimedia environmental benefits
  - economic value
  - energy security
  - jobs
  - endorsement of using measures by EPA and DOE

# How do we get from here

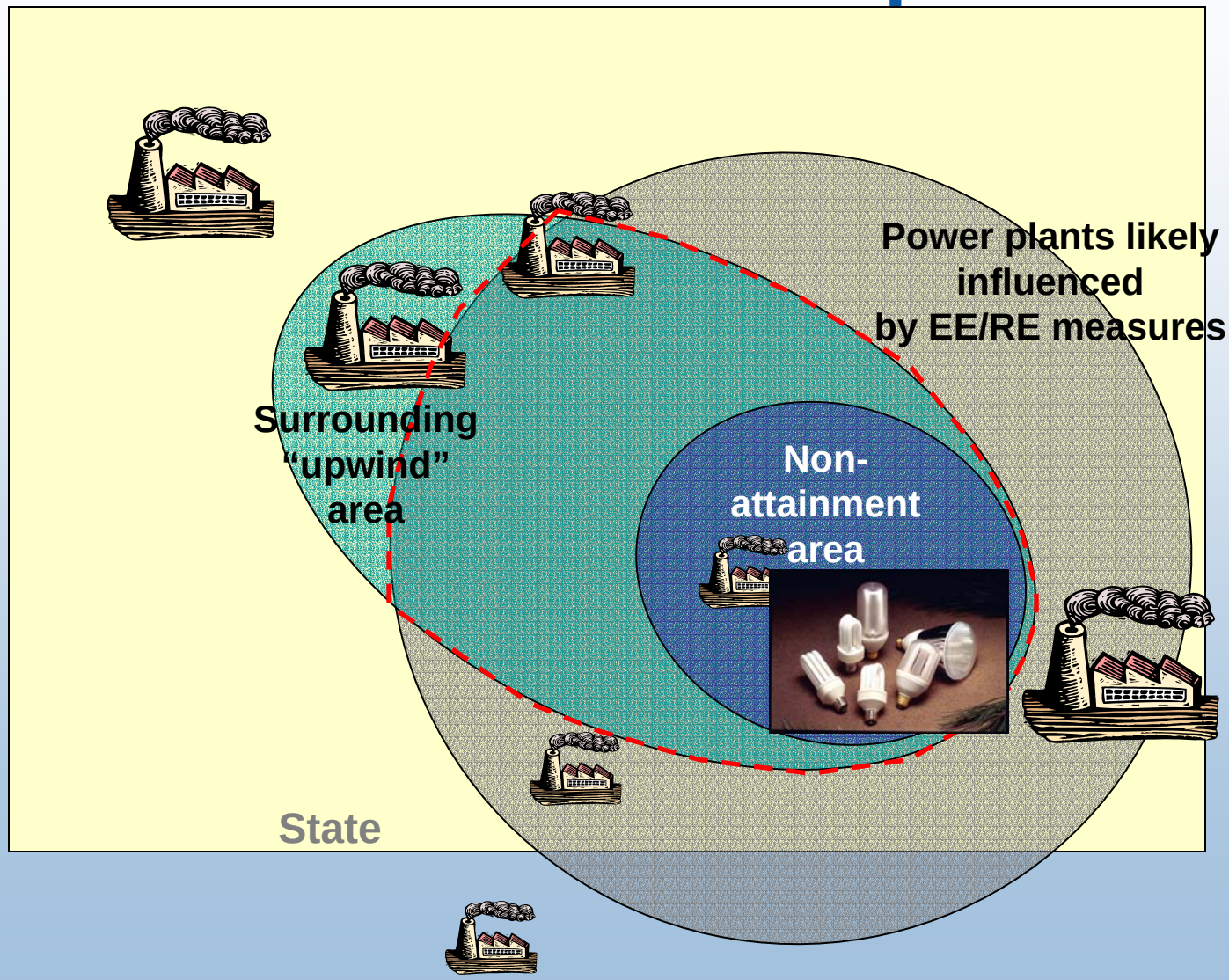
# Efficient Growth vs. Expansion



# Shreveport, La - Case Study

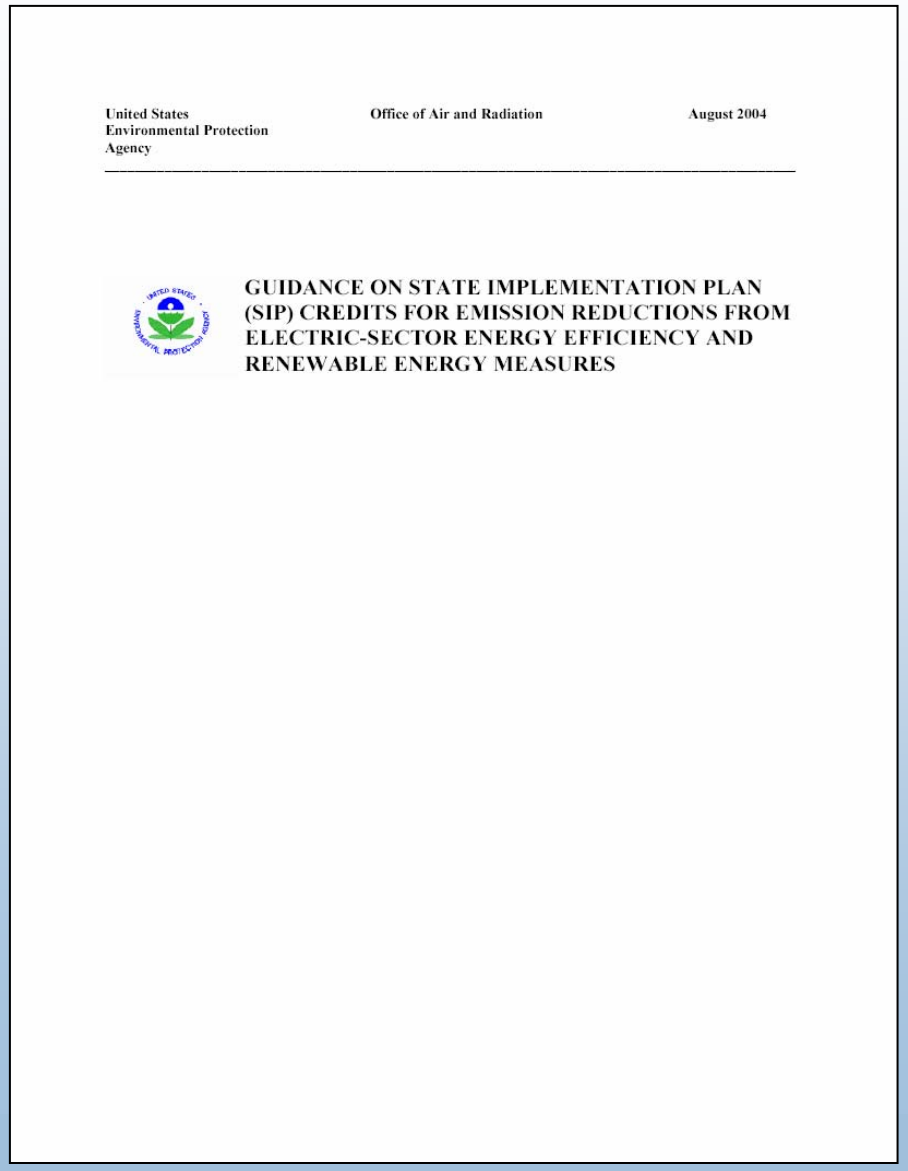
- 20-year Performance Contract between Johnson Controls Inc. and the City of Shreveport
  - 33 Municipal Buildings
    - Lighting upgrades and retrofits, programmable thermostats, pump motor replacements, etc.
- City of Shreveport is teetering on ozone nonattainment – Early Action Compact

# Efficient Growth vs. Expansion



# Monitored Air Quality Improvements

# Toolbox



United States Environmental Protection Agency | Office of Air and Radiation | August 2004

GUIDANCE ON STATE IMPLEMENTATION PLAN (SIP) CREDITS FOR EMISSION REDUCTIONS FROM ELECTRIC-SECTOR ENERGY EFFICIENCY AND RENEWABLE ENERGY MEASURES

Dedicated Crew

- USEPA
  - Headquarters
  - Region 6
  - RTP
- La DNR
- La DEQ
- US DOE
- LSU CES
- NREL

# Technical Details

## Energy Savings

- 20-year Performance Contract for 33 Municipal Buildings
- Base year of Analysis – 2000
- Energy Savings of 9,121,335 kWh/Yr – Guaranteed
- Annual true-up to ensure energy savings

## Three tracks to estimate emissions benefits

- Power Control Area Dispatch Method (EPA)
- Economic Dispatch Method (LSU CES)
- Plant Average Method (NREL)

## Per EPA Guidance, in order for emissions to be incorporated into the SIP they must be:

- Surplus
- Enforceable
- Permanent
- Quantifiable

| Table 2: Comparison of $NO_x$ Emissions Factors for Assessing EE Projects in the Shreveport Area | | | |
|---|---|---|---|
| Region | Annual $NO_x$ Emissions (Tons/yr) | Average $NO_x$ (Output Rate lbs/MWh) | O3 Season $NO_x$ (Output Rate lbs/MWh) |
| PLANT AVERAGE METHOD VARIANTS | | | |
| National | 5644353.87 | 2.96 | |
| O3 Season | 2431268.00 | | 2.92 |
| NERC Region - SPP | 354187.80 | 3.79 | |
| O3 Season | 164189.51 | | 3.73 |
| NERC Sub-Region – SPP South | 219962.16 | 3.42 | |
| O3 Season | 103484.54 | | 3.38 |
| State – La. | 118263.58 | 2.54 | |
| O3 Season | 55812.95 | | 2.59 |
| State and Power Provider – Louisiana & AEP | 11501.24 | 4.57 | |
| O3 Season | 5107.37 | | 4.63 |
| Electric Generating Company – SWEPCO | 40310.00 | 3.45 | |
| O3 Season | 18674.85 | | 3.39 |
| Power Control Area | 73796.33 | 3.70 | |
| O3 Season | 35478.18 | | 3.67 |
| Local Plants Supplying Shreveport – AEP Information | | 3.72 | |
| O3 Season | | | 3.79 |
| Local Plants in Shreveport and Caddo Parish | 632.77 | 1.95 | |
| O3 Season | 488.07 | | 1.95 |
| POWER CONTROL AREA DISPATCH METHOD | | 3.47 | |
| O3 Season | | | 3.37 |
| ECONOMIC DISPATCH METHOD | 35,169 | 2.95 | |
| O3 Season | 17,967 | | 2.85 |
| AVERAGES | | 3.32 | 3.30 |

# Environmental Benefits

NOx Emission Reductions ~ 3.3 lbs/MWh or approx. 15 Tons NOx/year

SO2 ~ 20.6 Tons/year

Hg ~ 1.4x 10E-4 Tons/year

Particulate Matter – plant specific

Greenhouse Gases

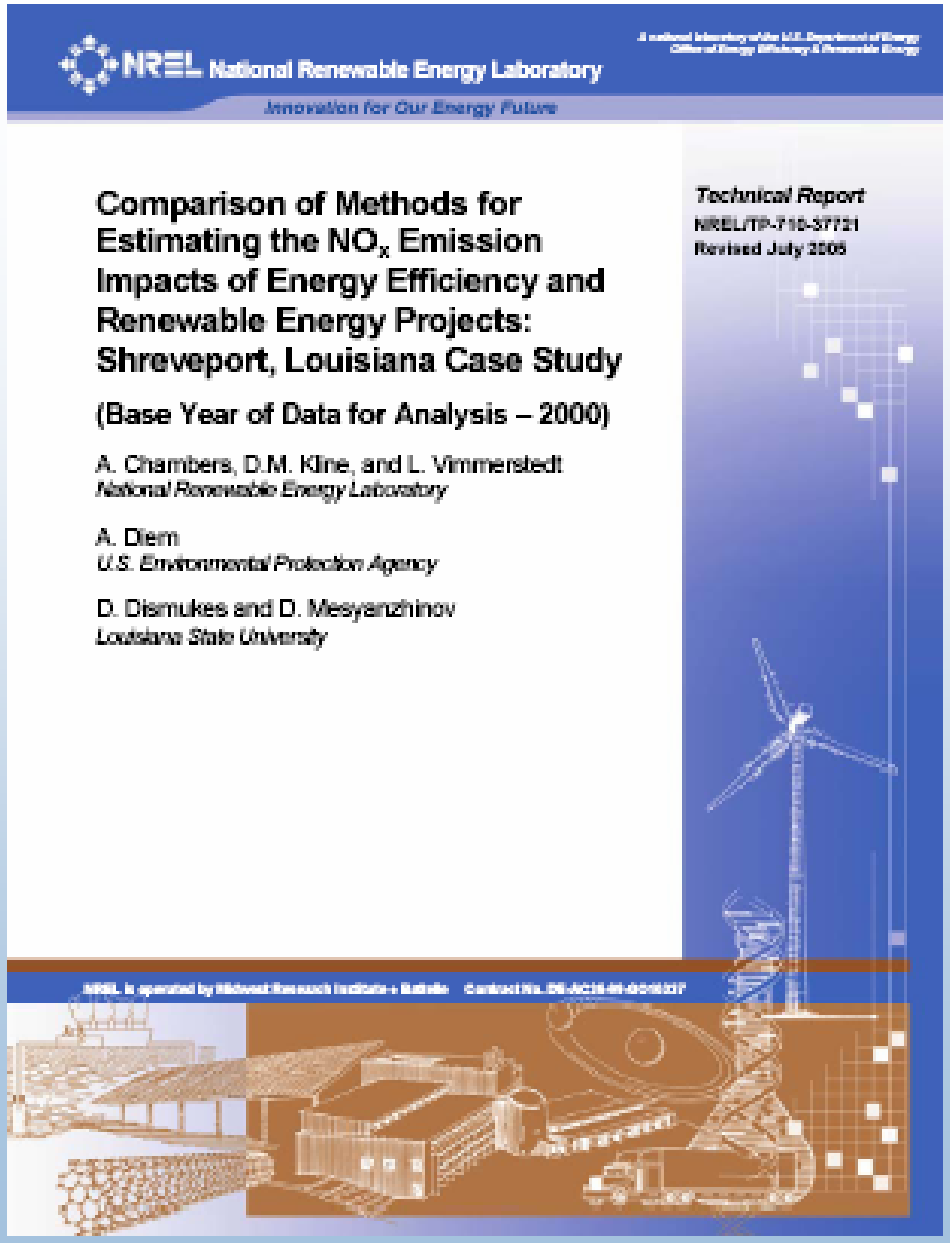
CO2 ~ 8,189 Tons/year

Water - 25 gallons of water withdrawal to produce 1 kWh coal fired generation

# Policy Relevance

- **SIP Process**
  - Local Emissions Documentation
  - ↓
  - State Acceptance of Emissions Reduction and Documentation
  - ↓
  - State Submission to EPA Regional Office
  - ↓
  - EPA Regional Office Acceptance and Public Comment Period
  - ↓
  - Review of Public Comments – Resolve Public Concerns
  - ↓
  - Formal SIP Adoption

- To be incorporated into the SIP emissions must be:
  - Surplus
  - Enforceable
  - Permanent
  - Quantifiable


NREL National Renewable Energy Laboratory
Innovation for Our Energy Future
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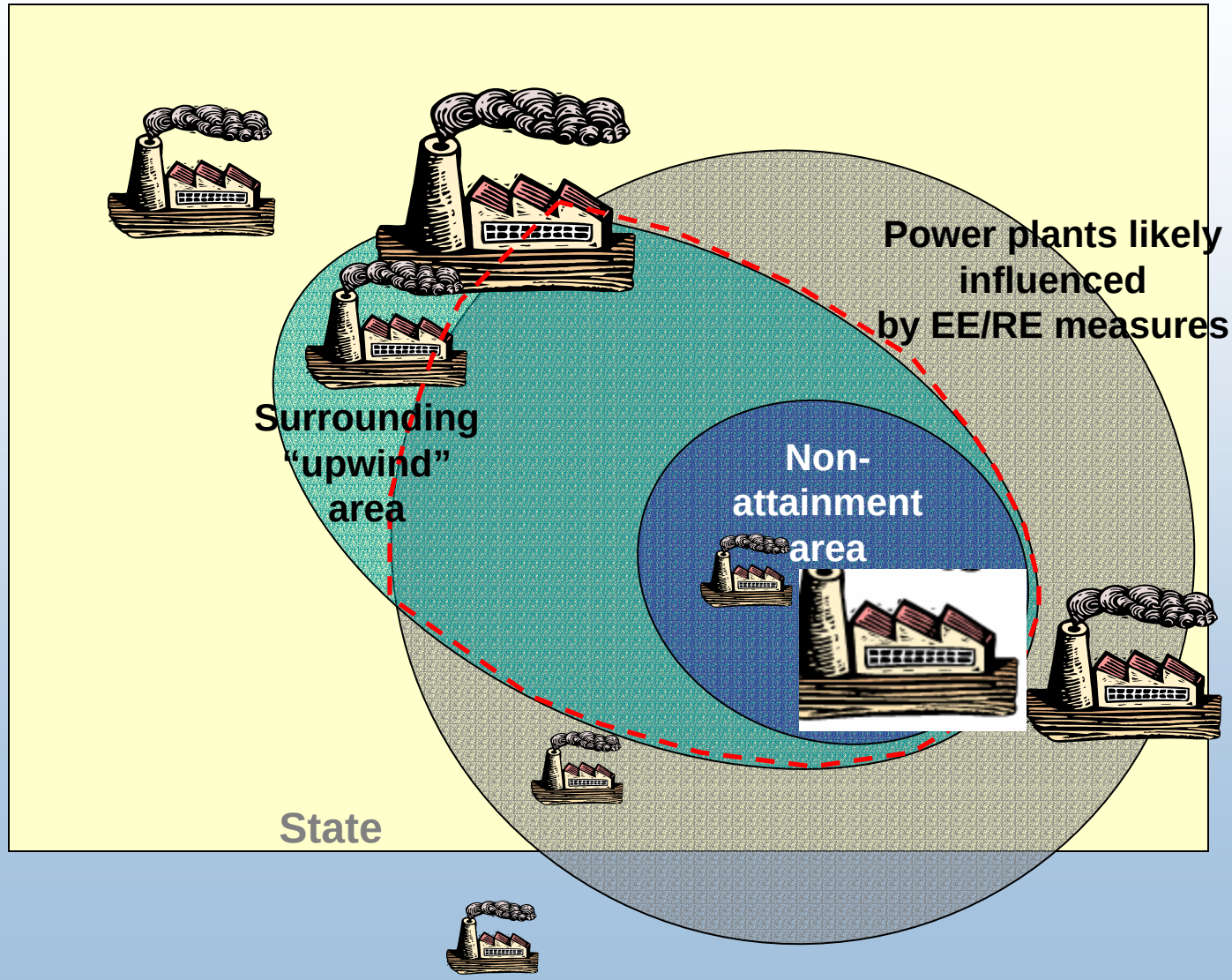
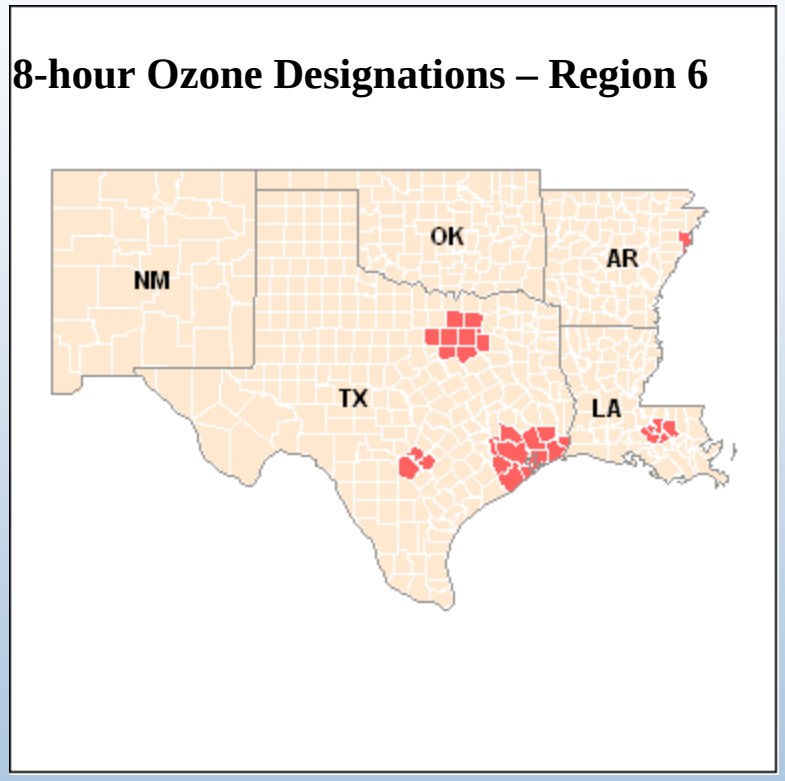
Louisiana State University
Technical Report
NREL/TP-710-37721
Revised July 2005

# Efficient Growth vs. Centralized Expansion



# Baton Rouge CHP Project

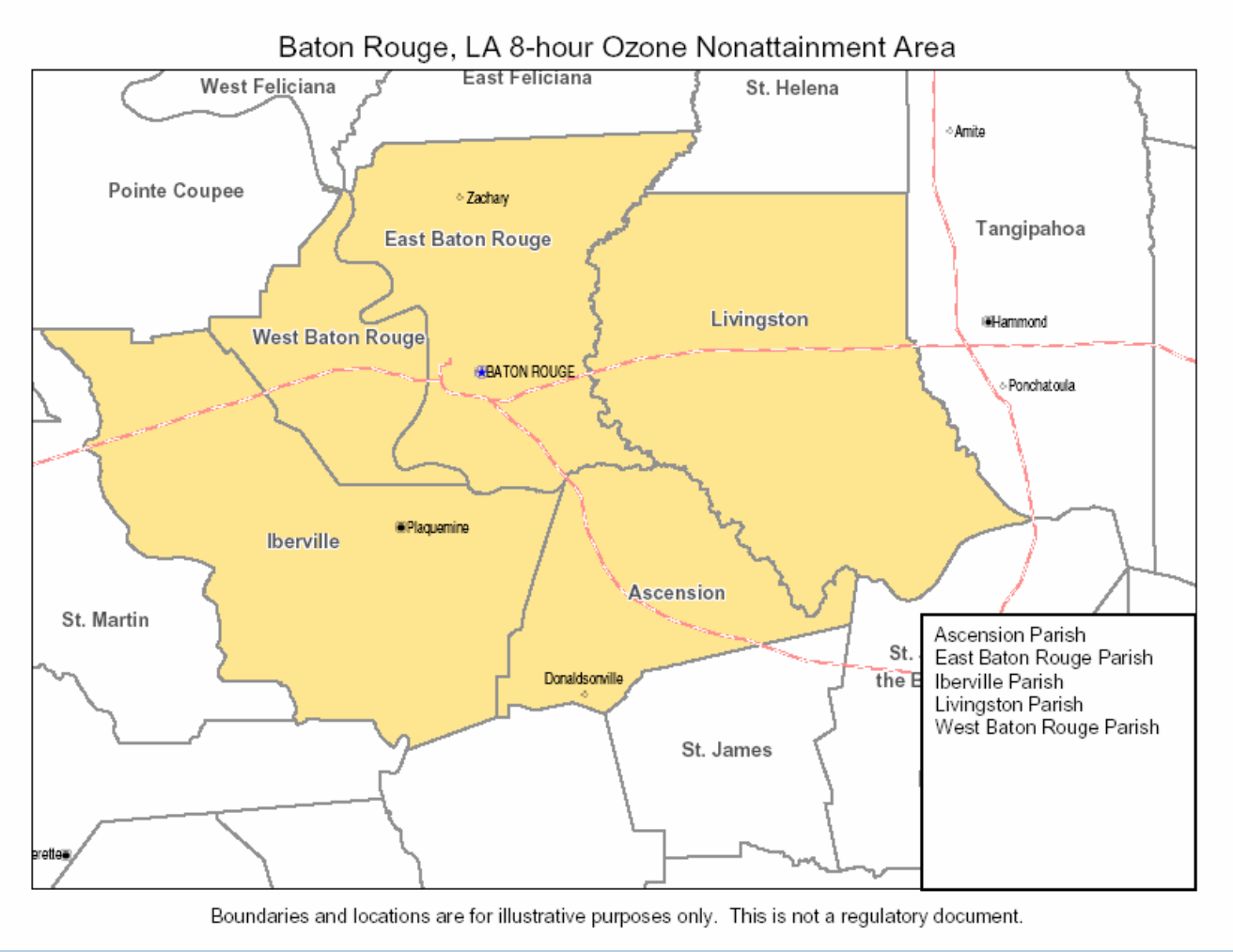



Bottom line ~

- 84 tons NOx/year

Other details remain to be sorted out.

Local generation avoids T&D losses ~ 8% line loss




# Can capacity expansion be avoided?

# Summary of Opportunities
# Building-Integrated Photovoltaics

Church in Sacramento, California (01096)

PV Shingles (04566)

House in Hopewell, New Jersey (04474)

Fort Dix, New Jersey (05180)

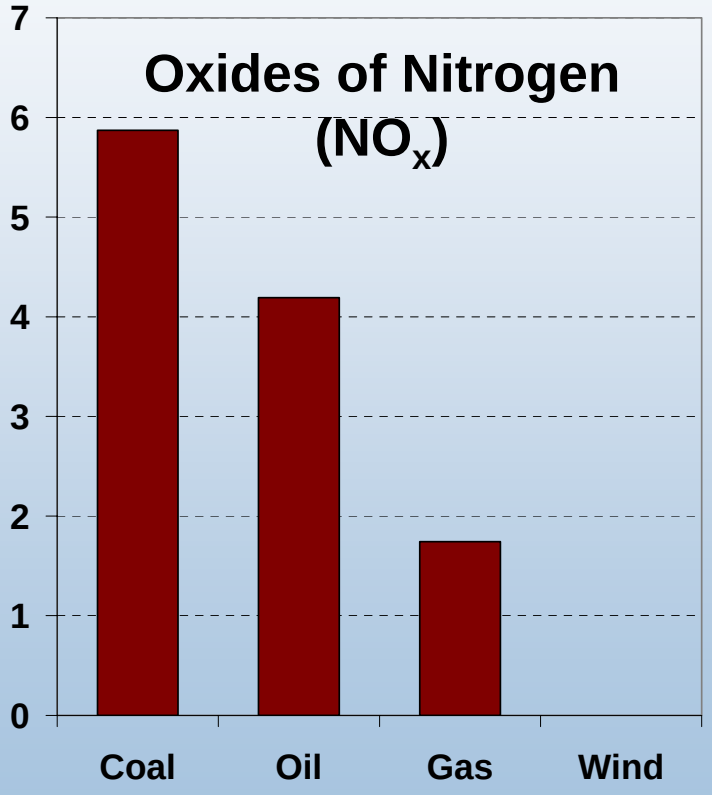
# Energy Efficiency

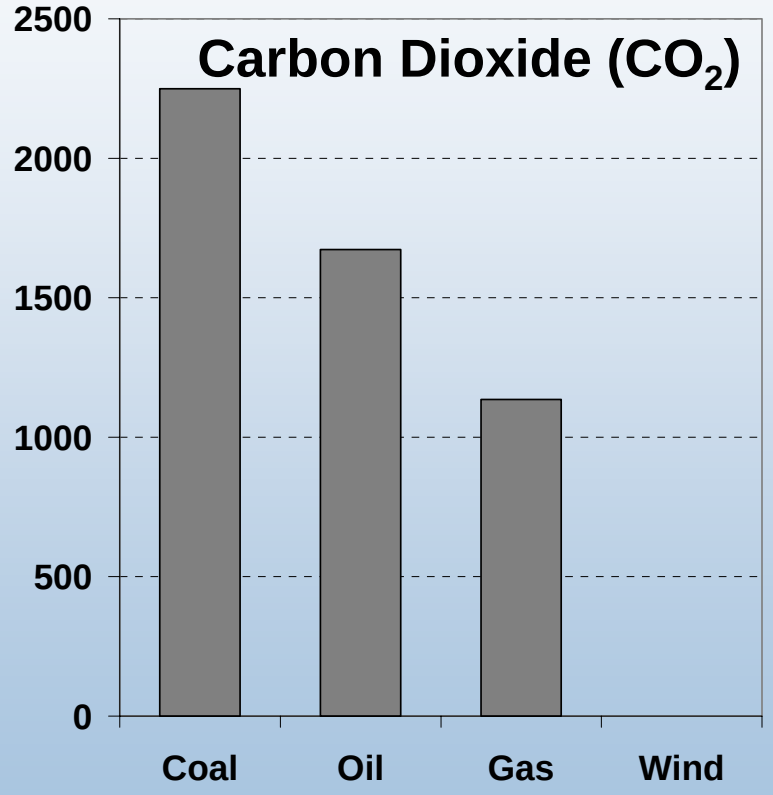
# Renewable Energy

# Other EE/RE drivers

- System Benefit Charge Programs
- Renewable Portfolio Standards
- Energy Codes
- Appliance Standards
- Gov. purchase
  - Green Power
  - LEED Buildings
  - EE equipment standards
- Utility run Demand Side Management Programs
- More …

# Emission Rates: Fossil vs. Wind (lb/MWh) (Year 2000)




Data Source: E-GRID2002 v2.0
Prepared by Art Diem USEPA

# Sticking Points

- Air Pollution cap and trade programs
- Nuclear power plant presence
- Merchant power plants
- Arduous SIP Approval Process
- Skeptics
- Comfort with uncertainty
- Not a silver bullet to solve air pollution problems

# Support

DOE Technical Assistance Program (TAP) & Pilot Projects in ILL, NJ, GA, and TX

EPA Co-Funding

Gratis Technical Support – LSU CES

**States and local folks make these projects happen!**

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# Thanks