Reinhold Environmental Ltd.

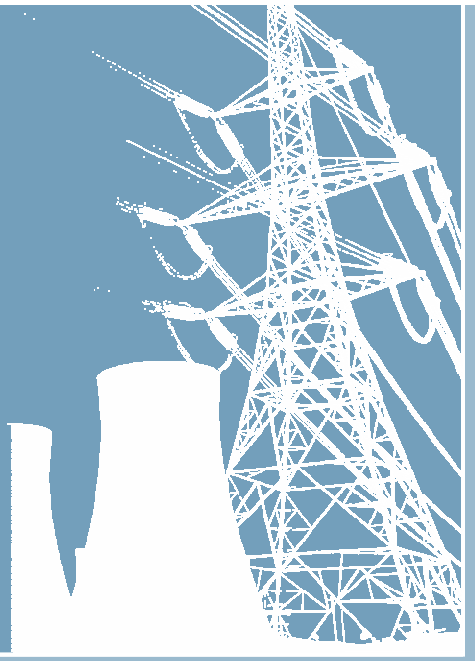
2009 NOx-Combustion Round Table & Expo Presentation

February 9 & 10, 2009, Cleveland, OH

Meeting the NOx Challenge

Gary Leidich

Executive Vice President and President, FirstEnergy Generation



NOx-Combustion/PCUG Conference

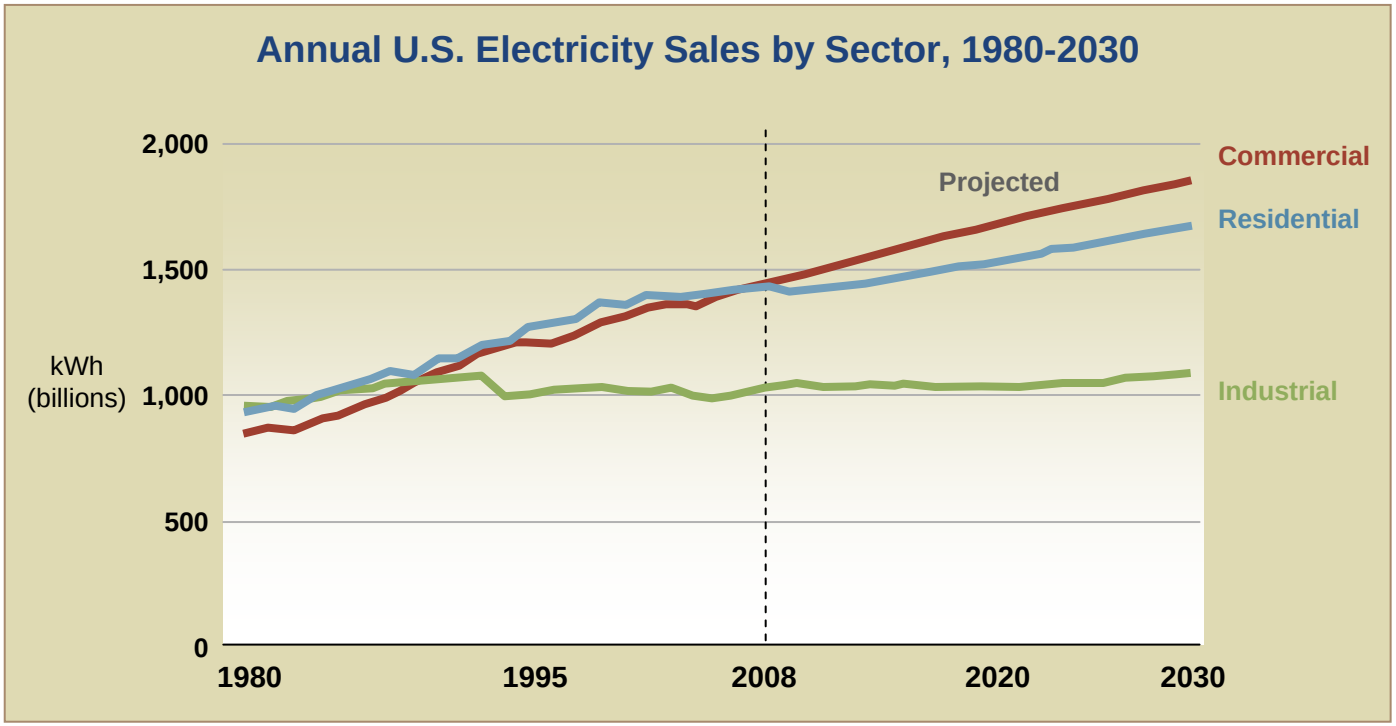
Cleveland Renaissance Hotel

February 9, 2009


Welcome to Cleveland

U.S. Electricity Growth Still Likely

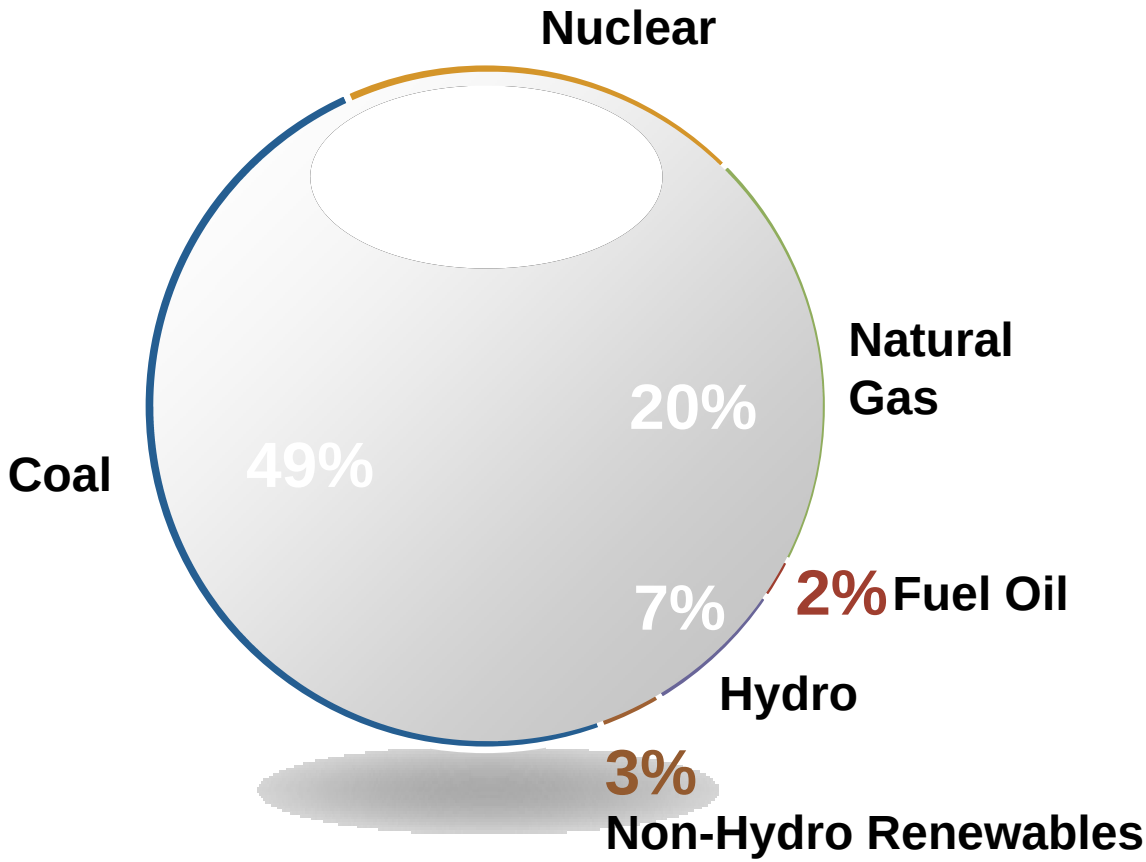
- **Growth in population and disposable income leads to increased demand for products, services and indoor space**
- **Population shifts to warmer regions also increase need for cooling**
- **New technologies create increased demand:**
  - Traditional TV: 209 kWh/yr; Plasma Screen: 680 kWh/yr



Source: Energy Information Administration, July 2008

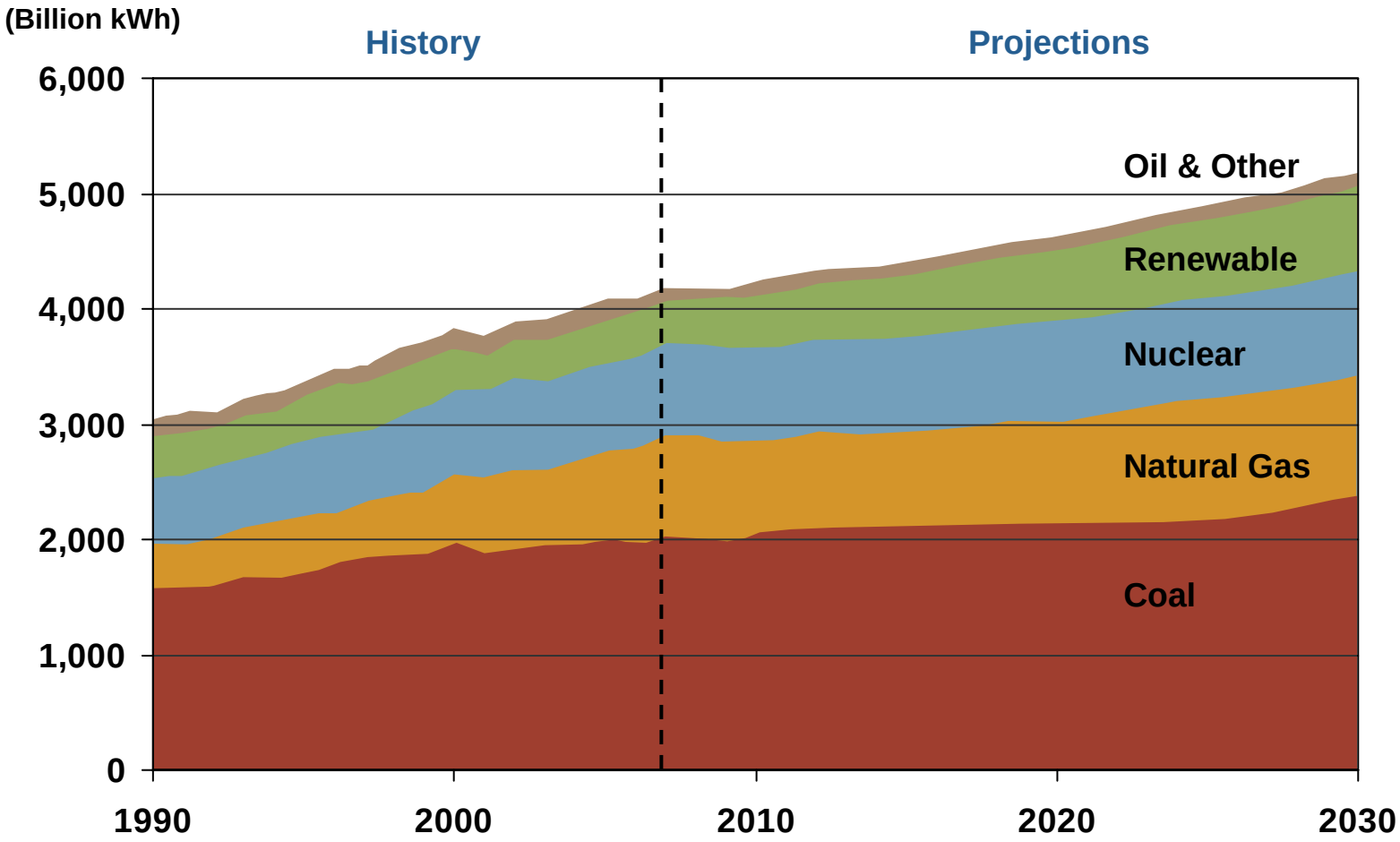
Nearly Half of U.S. Electricity Generated by Coal

Electric Companies Use a Diverse Mix of Fuels to Generate Electricity



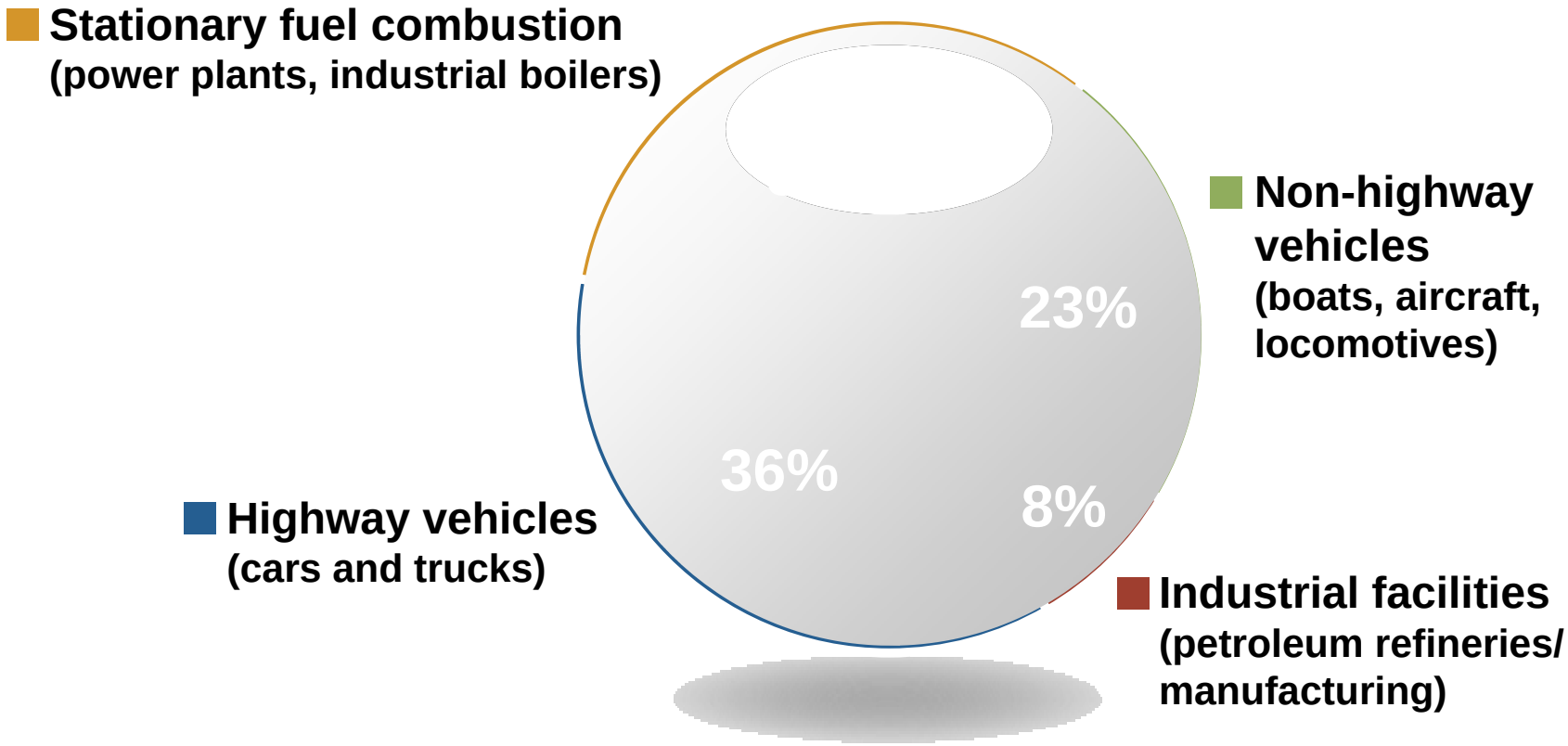
Source: EIA, 2007

Generation Mix Gradually Shifts to Lower Carbon Options



Source: EIA Annual Energy Outlook 2009 Reference Case Presentation

Distribution of NOx Emissions in the U.S. by Source Category



Source: EPA National Air Quality: Status and Trends Through 2007

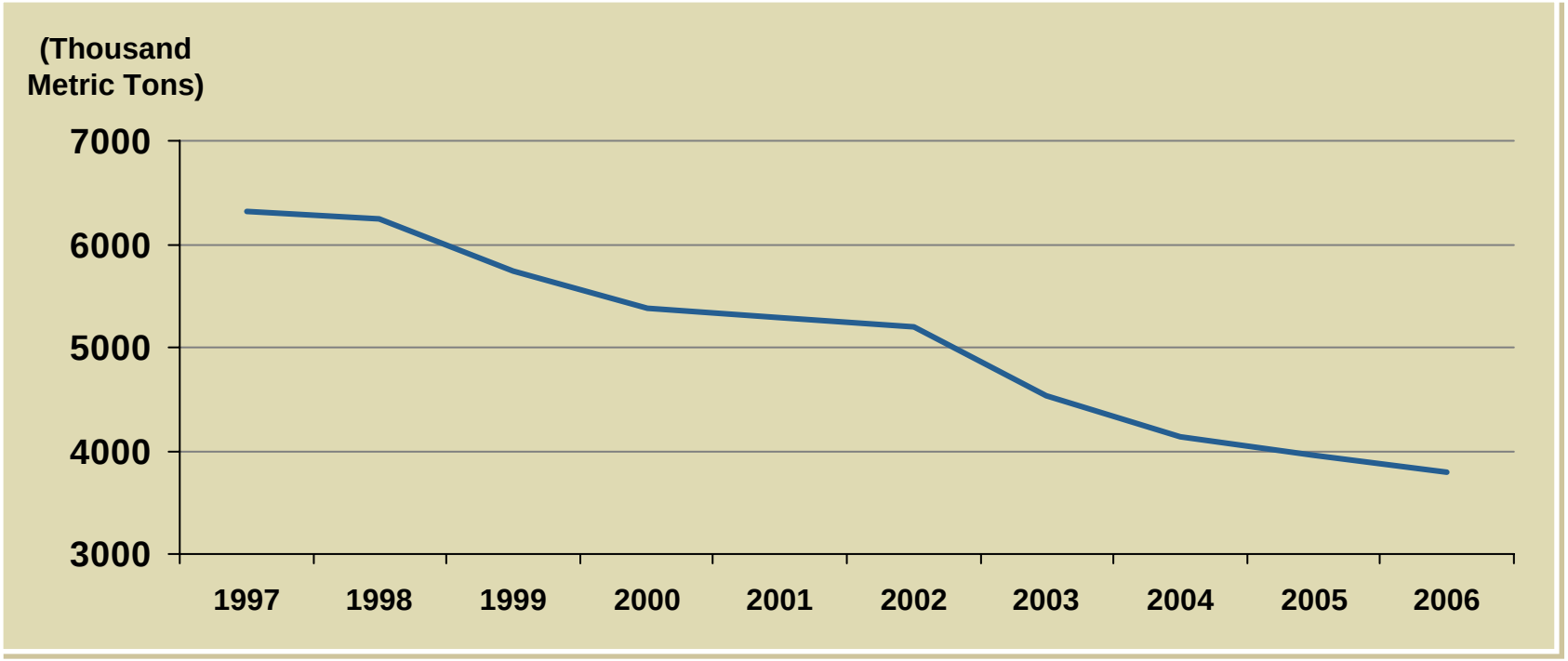
Coal-based Power Plants Produce Significant NOx Emissions

Environmental Impact of NOx a Major Concern

- **Clean Air Interstate Rule (CAIR)**
  - EPA issued CAIR in 2005
  - Required additional reductions of sulfur dioxide (SO_2) and nitrogen oxides (NOx) emissions that move across state boundaries
  - Permanently caps emissions of SO_2 and NOx in 28 states
  - When fully implemented, CAIR will reduce SO_2 emissions by over 70 percent and NOx emissions by over 60 percent from 2003 levels
  - D.C. Circuit Court vacates CAIR in July 2008 and remands rule to EPA December 2008
    - CAIR is reinstated in full and EPA has a court order to reformulate the rule (no deadline given)
  - New rule will likely be more stringent than the current version of CAIR

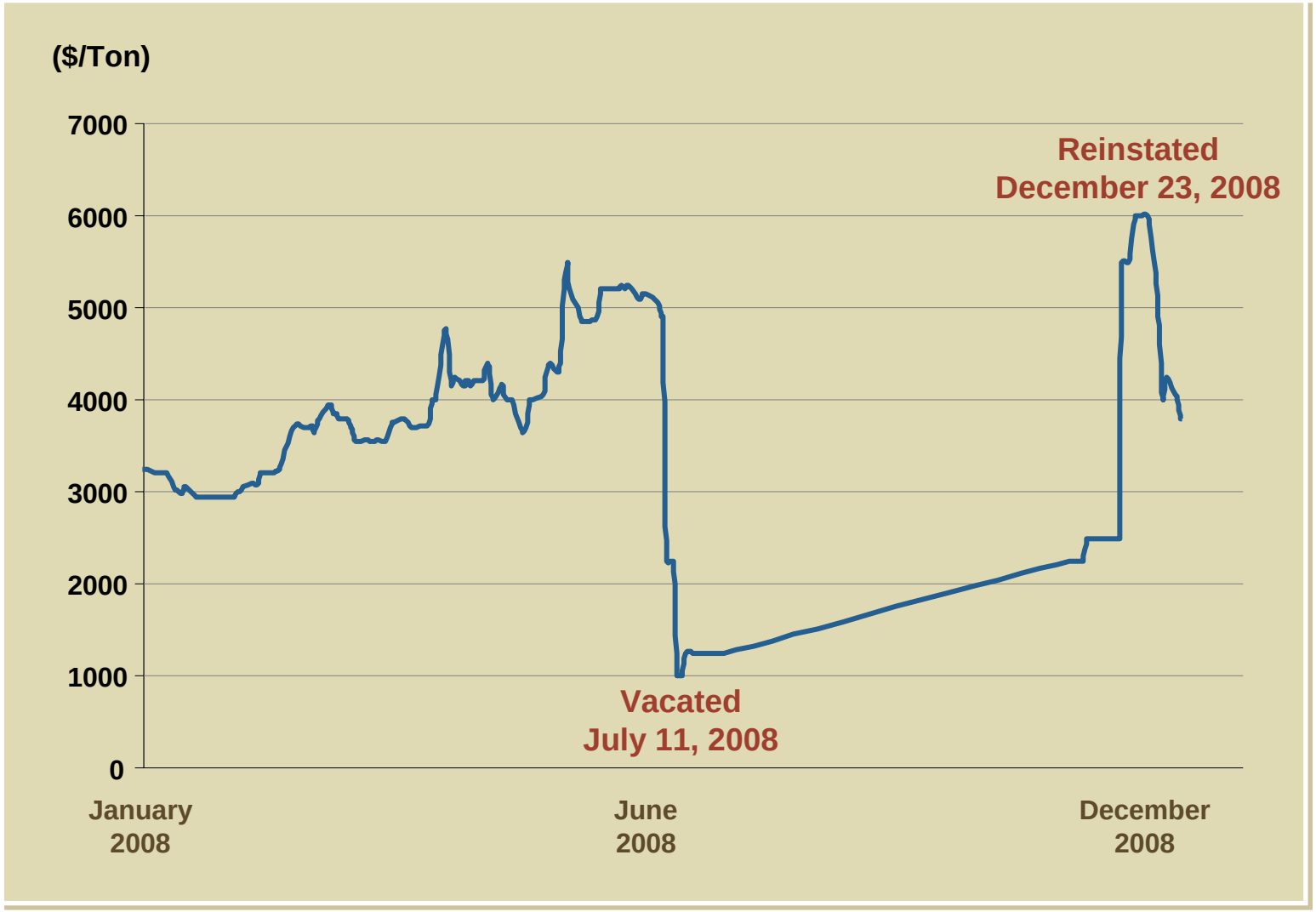
NOx Emissions From Fossil-Based Electricity Production Decreasing

- **Clean Air Act (1990)**
- **NOx SIP Call (2003)**
- **CAIR (2005)**



Source: EIA, Electric Power Annual Report, 2007

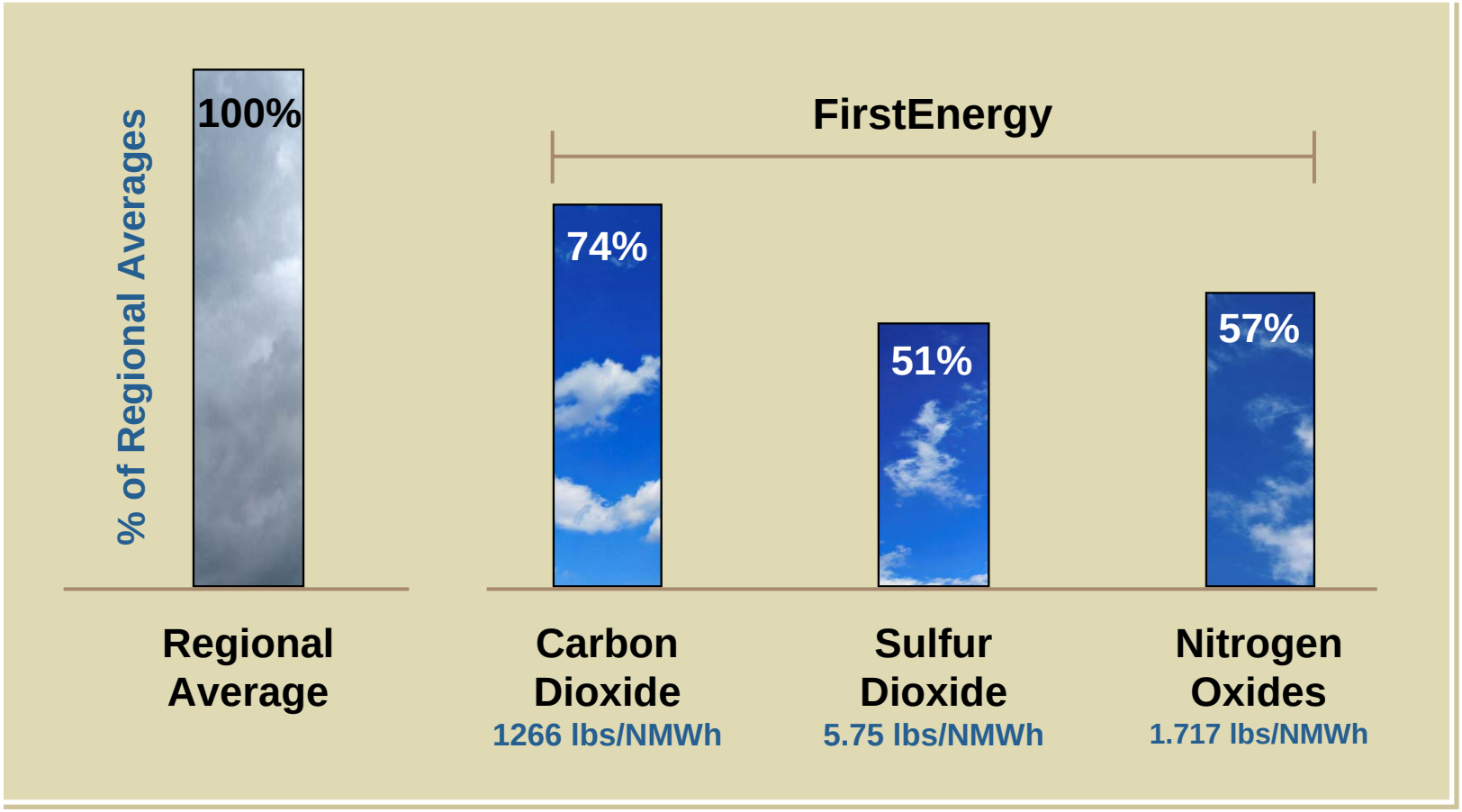
Annual NOx Allowance



FirstEnergy Producing Electricity in an Environmentally Sound Manner

- **FirstEnergy companies have spent more than $5 billion on environmental projects since the Clean Air Act became law in 1970**
- **Our power plant emissions rates are significantly lower than regional average due to nuclear fleet and pollution control equipment**
- **Since 1990, we've reconfigured our fleet and avoided some 150 million tons of CO_2 emissions**

FirstEnergy Emission Rates as a Percentage of Regional Generation Averages (including nuclear)



Source: Regional emission rates from the Public Utilities Commission of Ohio

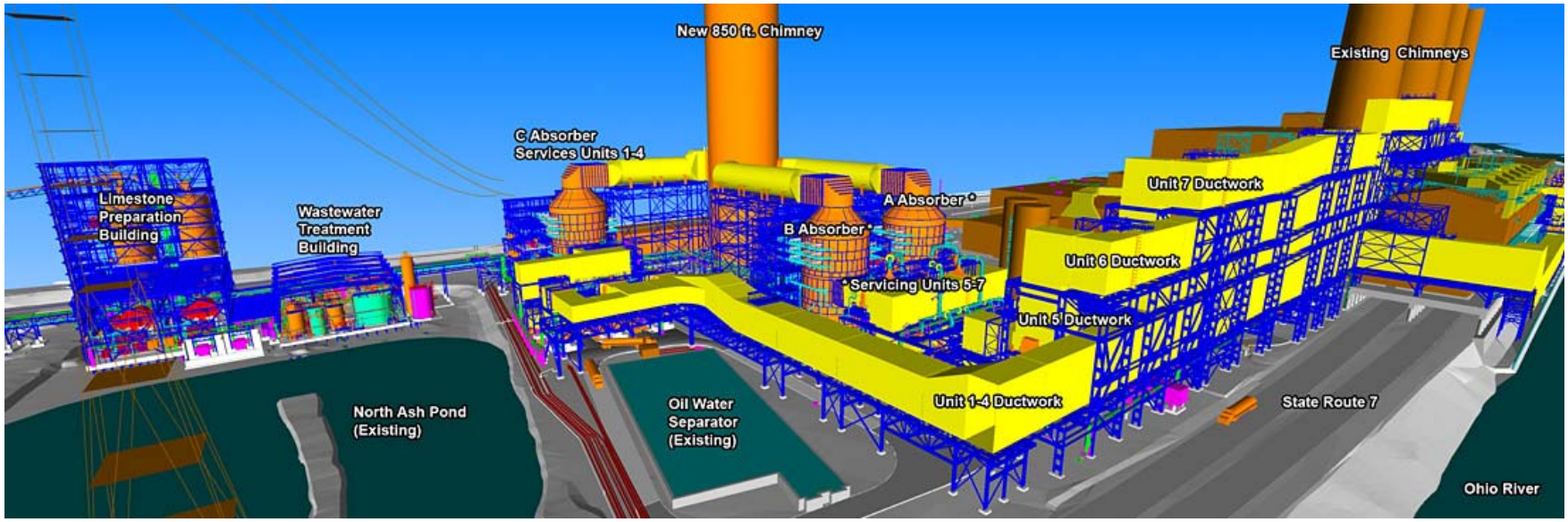
FirstEnergy Investing Significantly in Environmental Projects

- **Sammis Plant in Stratton, Ohio – $1.65 billion project**
  - One of the largest environmental retrofit projects in the nation
  - Multi-year project began in 2006 – completion expected in 2010
  - Designed to reduce SO_2 emissions by 95% and NOx by at least 64%
- **Mansfield Plant – $50 million project**
  - SO_2 control (scrubber) upgrades

Sammis Air Quality Compliance (AQC) Project

Sammis AQC Project

Sammis AQC Project



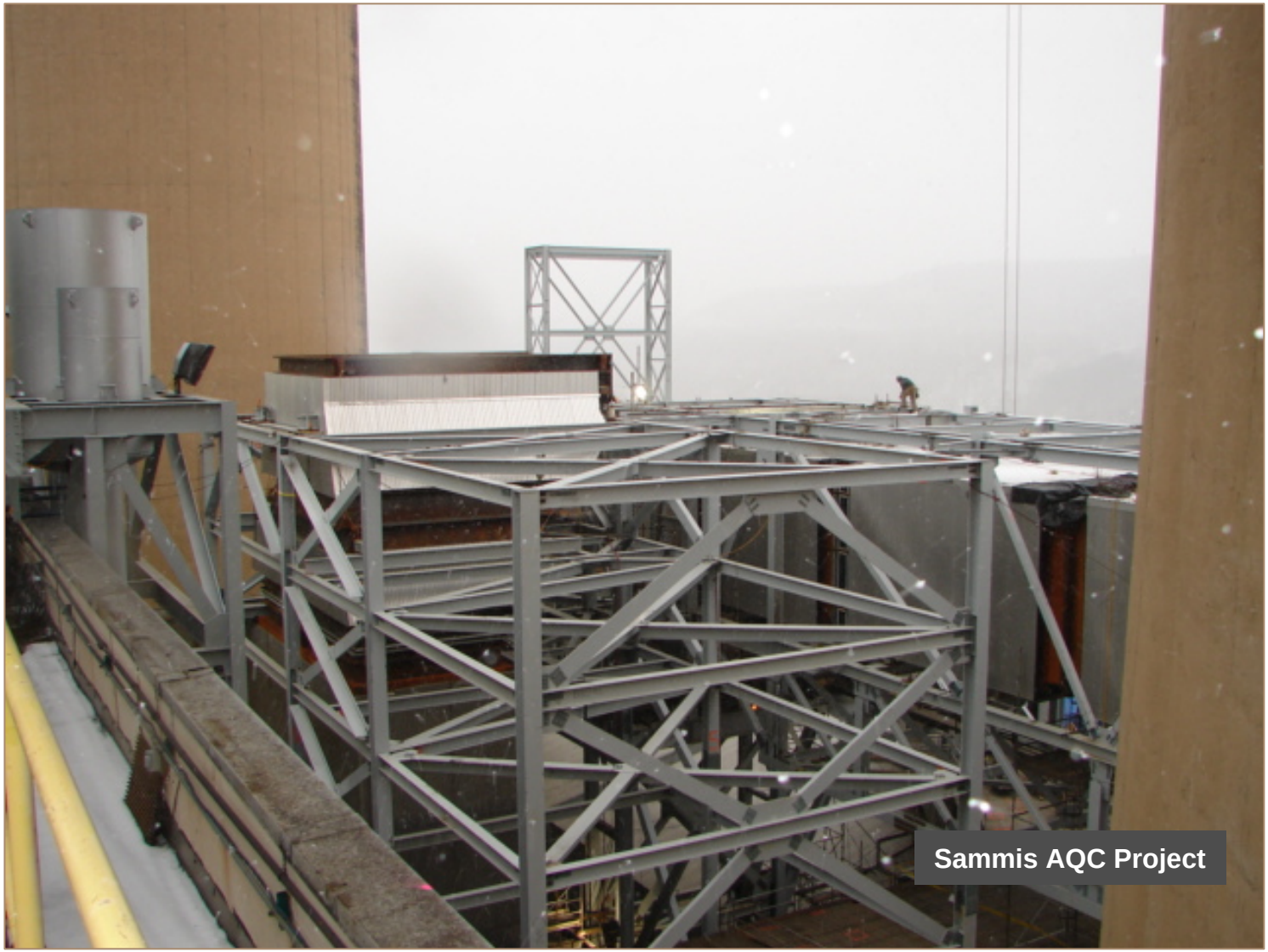
Great Wall

Great Wall Looking East

Unit 5 Breaching and Great Wall

Great Wall Breaching

F-Center Units 5 and 6 Steel and Breaching



C-Breaching Duct (Units 1-4, 760 GMW)

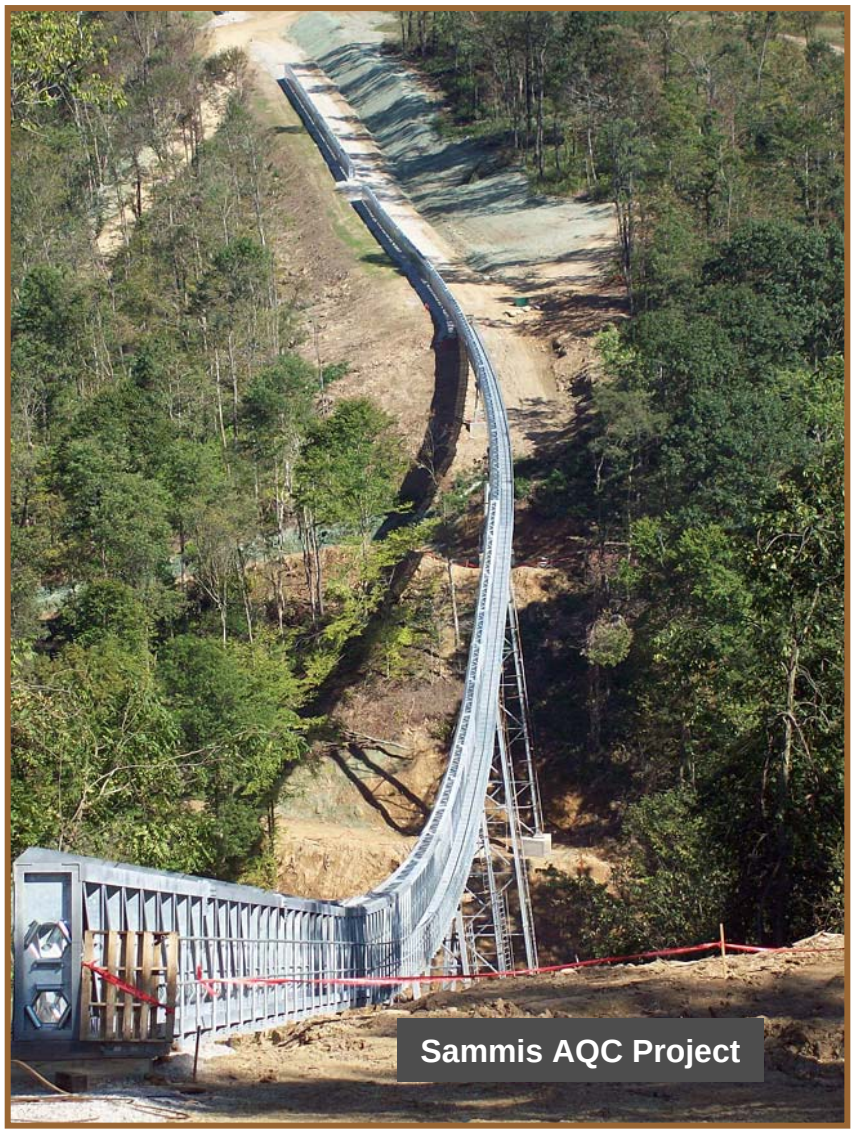
C-Absorber Inlet Breaching Support Steel

Dewatering Area and South Yard

Transport of Flue Section to Chimney

Limestone Transfer Conveyor to Prep Building

Gypsum Conveyor

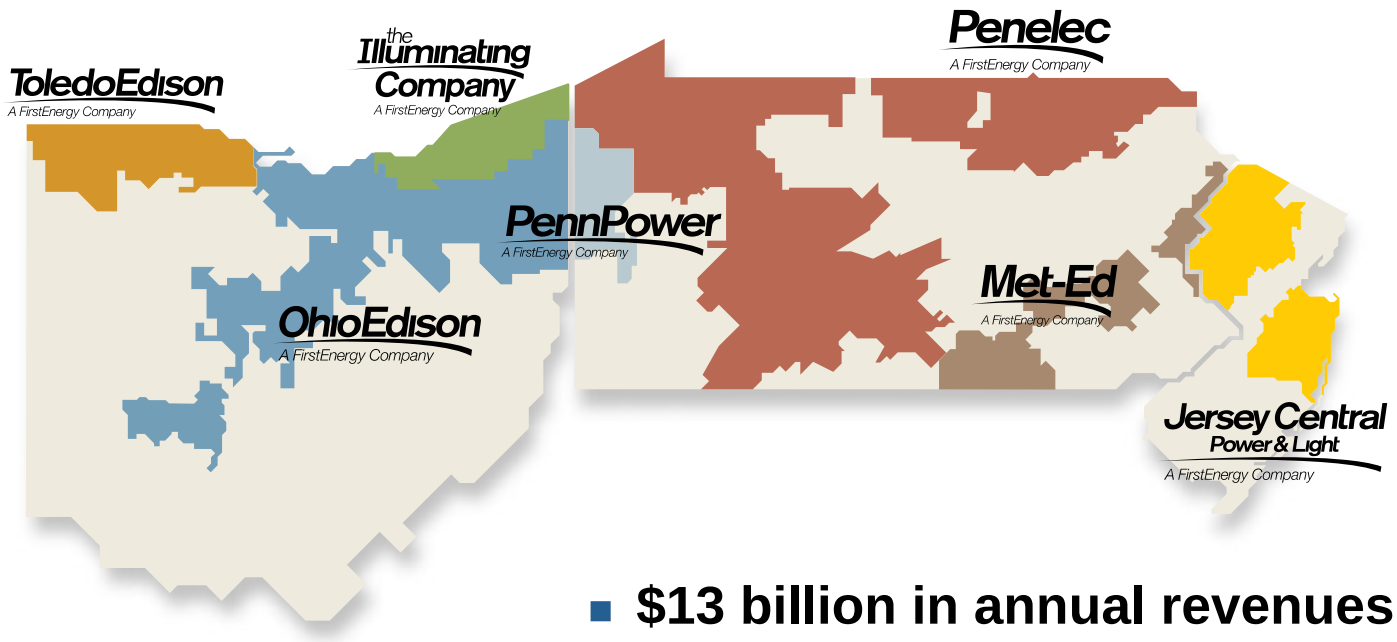


Hollow Rock Facility

FirstEnergy Corp.

- **Headquartered in Akron, Ohio**
- **Seven electric utility operating companies**
- **5th largest investor-owned electric system in the U.S. based on 4.5 million customers served**
- **Ranked 209 among Fortune 500 companies in 2008**

FirstEnergy Summary Profile



- **$13 billion in annual revenues and $32 billion in assets**
- **18 generating plants; more than 14,417 MW**
- **Approx. 133,000 transmission and distribution circuit miles**
- **Approx. 14,500 employees**

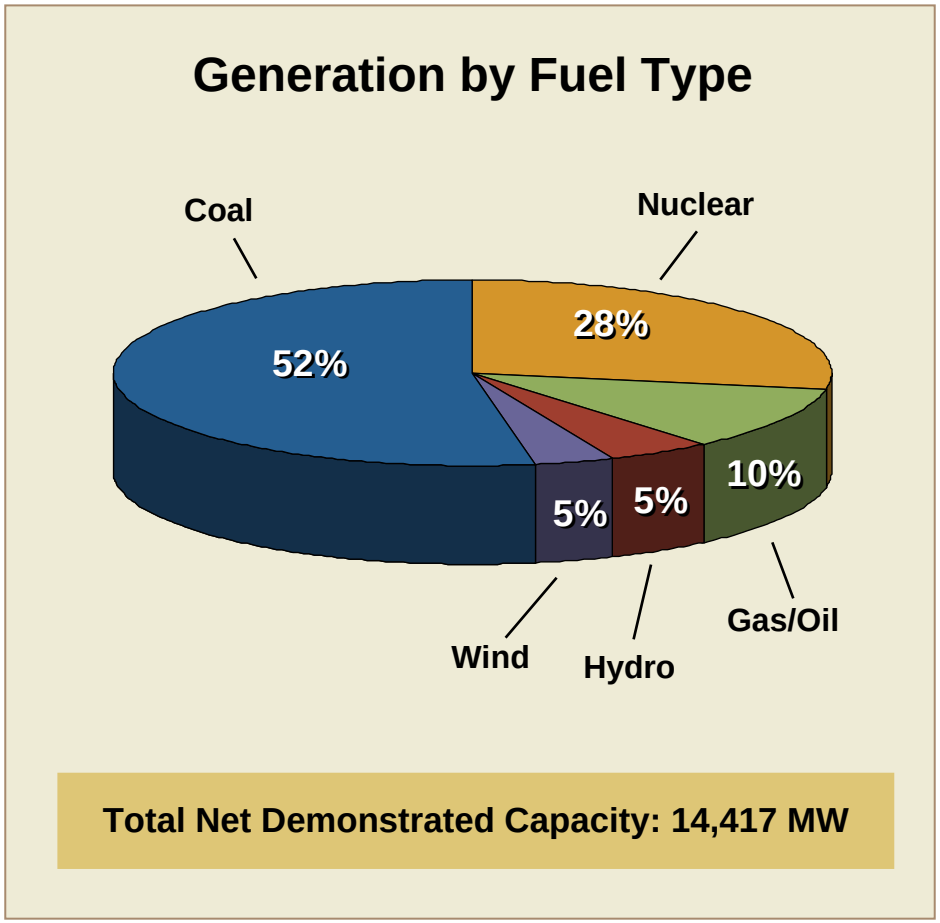
Rankings Among Electric Utilities
(12 mos. ended 12/31/2007)

Assets	**11**
Customers	**5**
Revenues	**11**
Market Cap (as of 2/29/08)	**7**

Source: EEI

FirstEnergy Well Positioned to Operate in Carbon-Constrained Environment

Diverse Generating Sources



- **Approximately 60% of generation comes from low or non-emitting nuclear, scrubbed coal-based and natural gas peaking plants**
- **Long-term agreements for 376 MW of wind generation**
- **Investing in power uprates and license renewals for fossil and nuclear plants**

A Flexible Approach to Implementing Pollution Control Technology

FirstEnergy Coal-Fired NOx Control

- **Sammis Plant Units 1-7**
  - Low NOx Burners and Over Fire Air / Selective Non-Catalytic Reduction / Combustion Optimization System and Powder River Basin fuel blending. Unit 6 Selective Catalytic Reduction 2009, Unit 7 SCR 2010
    - Sammis 6 and 7 SCR screen designs incorporate the latest evolution of Large Particle Ash (LPA) protection
    - Sammis 6 and 7 enhanced operating approach will increase the range of operation at lower loads and lower SCR operating temperature without impacting performance
- **Bruce Mansfield Plant Units 1-3**
  - LNB, OFA and SCR
    - Plant technical staff engineered SCR LPA mitigation based on equipment reliability issues and utility experience
- **Burger Plant Units 4 and 5**
  - LNB / SNCR and PRB fuel blending

A Flexible Approach to Implementing Pollution Control Technology

FirstEnergy Coal-Fired NOx Control (continued)

- **Ashtabula 5**
  - LNB / OFA / PRB fuel blending
    - Installed pulsed detonation system to reduce LTSH and economizer fouling
      - Increased unit reliability and improved boiler efficiency
- **Bay Shore Units 1-4**
  - LNB / OFA / PRB fuel blending
  - Unit 1: Circulating Fluidized Bed boiler with petroleum coke fuel supplied by BP refinery. Very low NOx
- **Eastlake Units 1-5**
  - LNB / OFA/ COS / SNCR / PRB fuel blending
    - Flame Doctor application on Eastlake 5
- **Lake Shore 18**
  - Tangential fired unit combusting PRB
  - Design Net Heat Rate of 9120Btu/KWh (steam driven FD fans and boiler feed pumps)

FirstEnergy engineering and technical staff play a vital role in plant-specific NOx control technology optimization

FirstEnergy Taking a Leadership Role in Testing Environmental Technologies

Examples of Technology Investments

- **Energy storage technology demonstrations**
- **FirstEnergy Advanced Energy Research Center at The University of Akron**
  - $2 million to support coal-based fuel cell research
- **Cuyahoga Valley National Park – small-scale fuel cell pilot**
- **Eastlake Plant**
  - Moving Bed Reactor project demonstration for NOx control
- **Burger Plant**
  - Powerspan ECO and ECO_2 technology
  - Algae research project

Meeting Demand Through Flexible NOx Control Applications

- **Increasing demand for energy and electricity**
- **Environmental impact is a trade-off…**
  " there's no free lunch"
- **Technological advances critical to meeting future demand for energy in environmentally responsible manner**