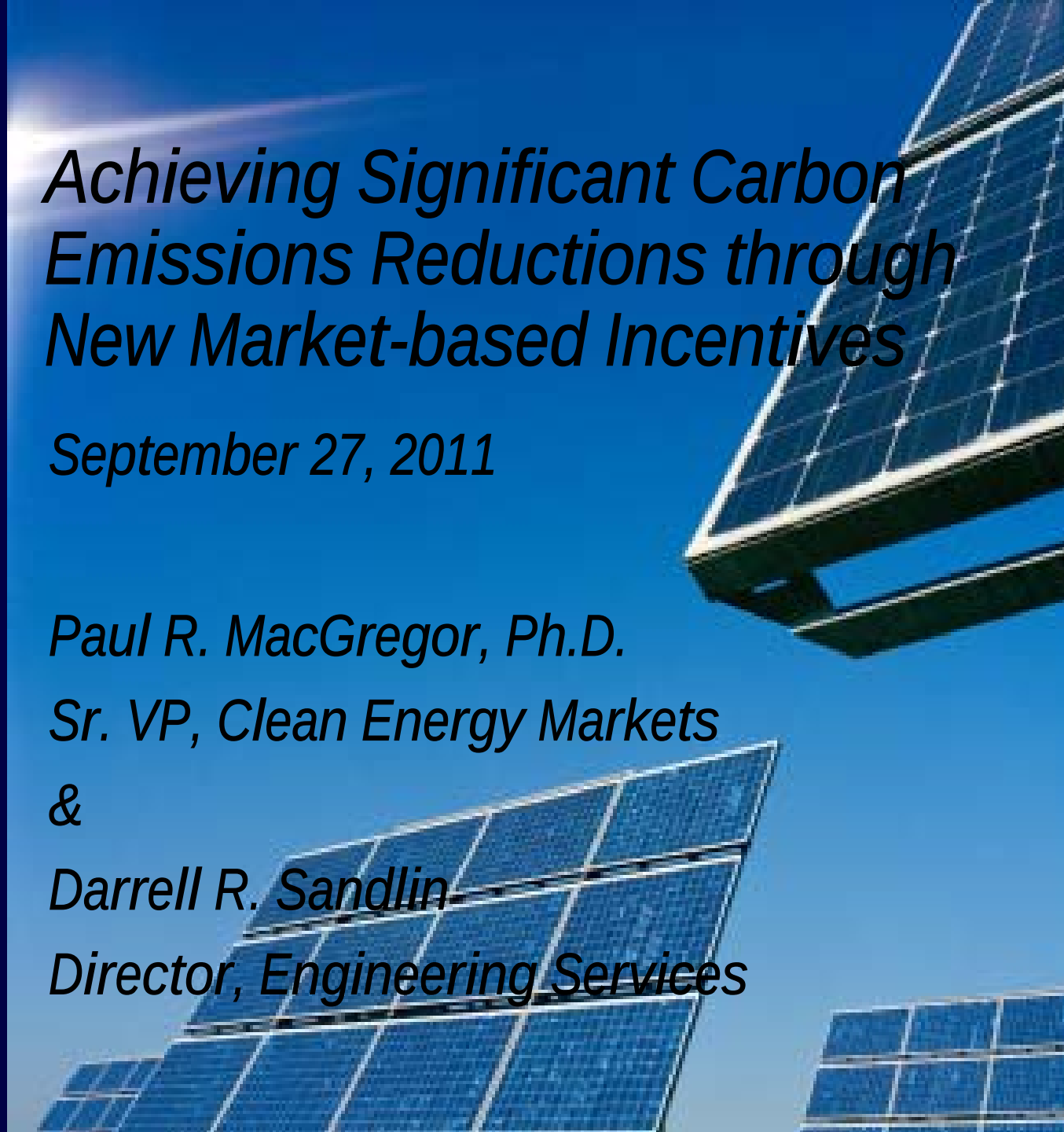

Achieving Significant Carbon Emissions Reductions through New Market-based Incentives

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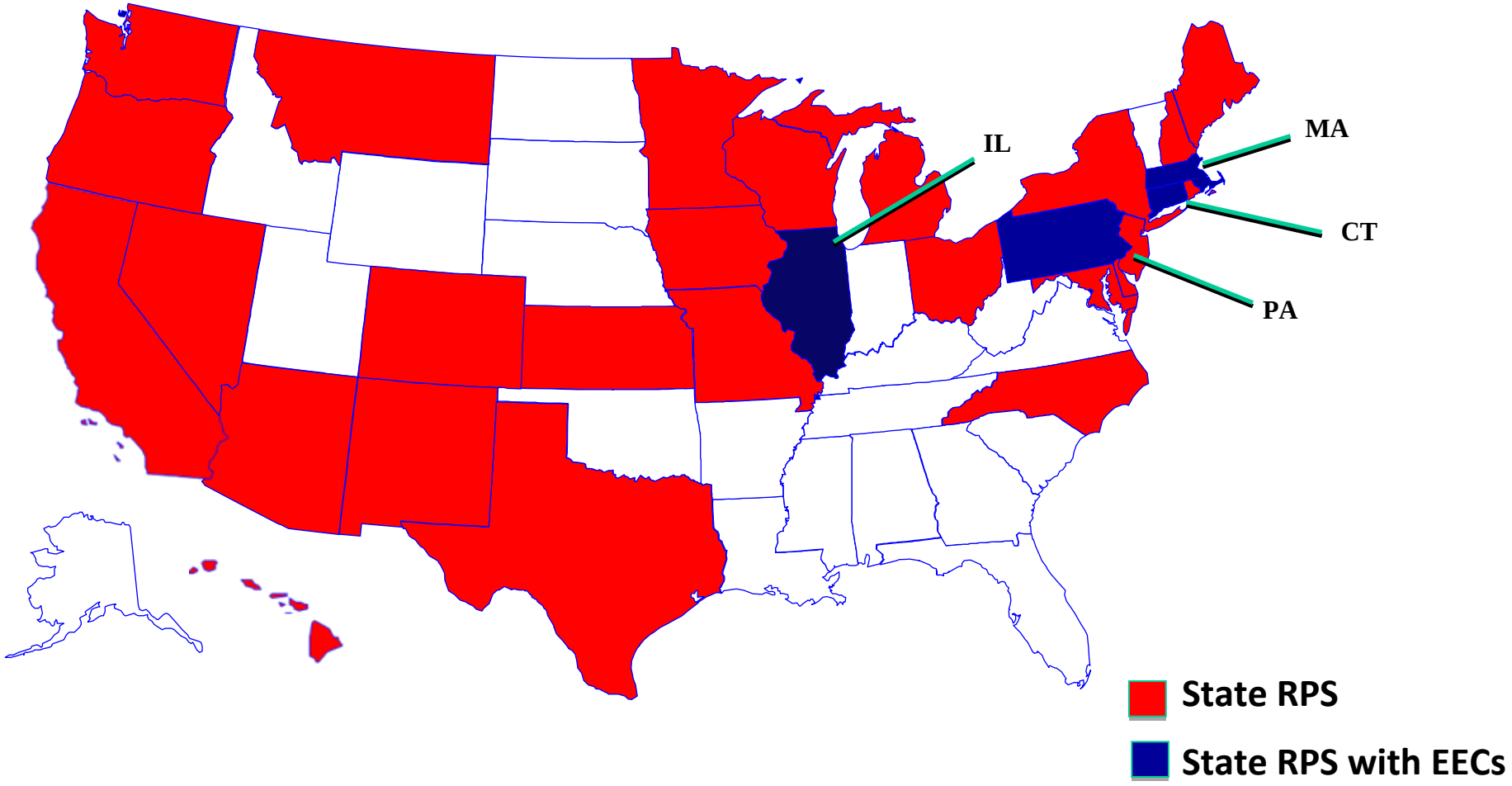
Nexant
Clean Energy Markets

Renewable Portfolio Standards

29 States & DC have an RPS



Energy Efficiency Certificates (EECs)

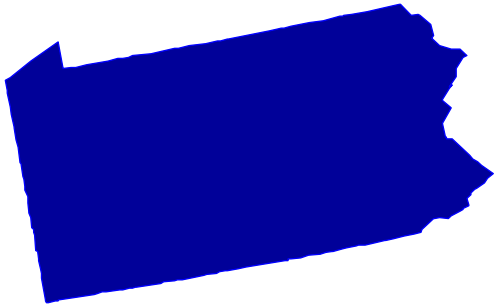
- **Tradable Credits to Incentivize Investment**
- **Retail Electricity Suppliers Must Purchase**
- **Represents the Energy (Electricity) Saved**
- **Technologies**
  - Operational Changes
  - Technology Replacements
  - Waste Heat Recovery
  - Cogeneration / Combined Heat & Power

Energy Efficiency Certificates (EECs)

- **Promotes Efficient, Firm, Distributed, Clean Power**
- **Short-term Cost - Rate Increase < 1%**
- **Long-term Savings – Avoided Costs**
  - New Generation Plants
  - New Transmission Lines
  - Increases Reliability Existing Grid
- **Leverages Private Capital**
- **Stimulates Local Job Growth**
- **Reduction in Emissions (CO2, SO2, NOx)**

State Programs

- **Pennsylvania**
  - Combined Efficiency Tier
  - 1 MWh generation = 1 EEC
  - ACP = $45
  - DG, DSM, Large Hydro, MSW, Wood Waste, IGCC & Waste Coal
  - Formal M&V application + Revenue metering
  - Requirements 4.2% in 2007, 6.2% in 2011 and 8.2% in 2016
  - Only 1 qualified CHP as DG in PA RPS (Nexant)
  - EEC prices ~ pennies ($/MWh)

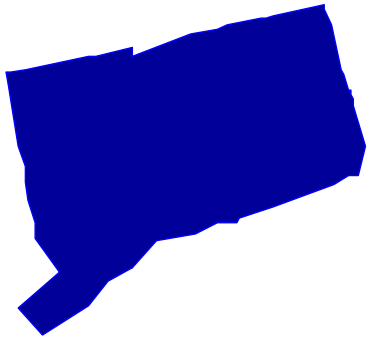


State Programs

- **Illinois**
  - Incorporated Efficiency In Existing Single Tier
  - Waste Heat & CHP eligible
  - Minimums Requirements for Wind & Solar
  - Allows Out-of-State Projects to Participate
  - Lowest Total Cost > Budget-based “ACP”
  - Requirements 2% in 2009, increasing to 25% per year in 2026
  - Only 1 qualified CHP (Waste Heat) in Illinois (Nexant)
  - EEC prices < a dollar ($/MWh)

State Programs

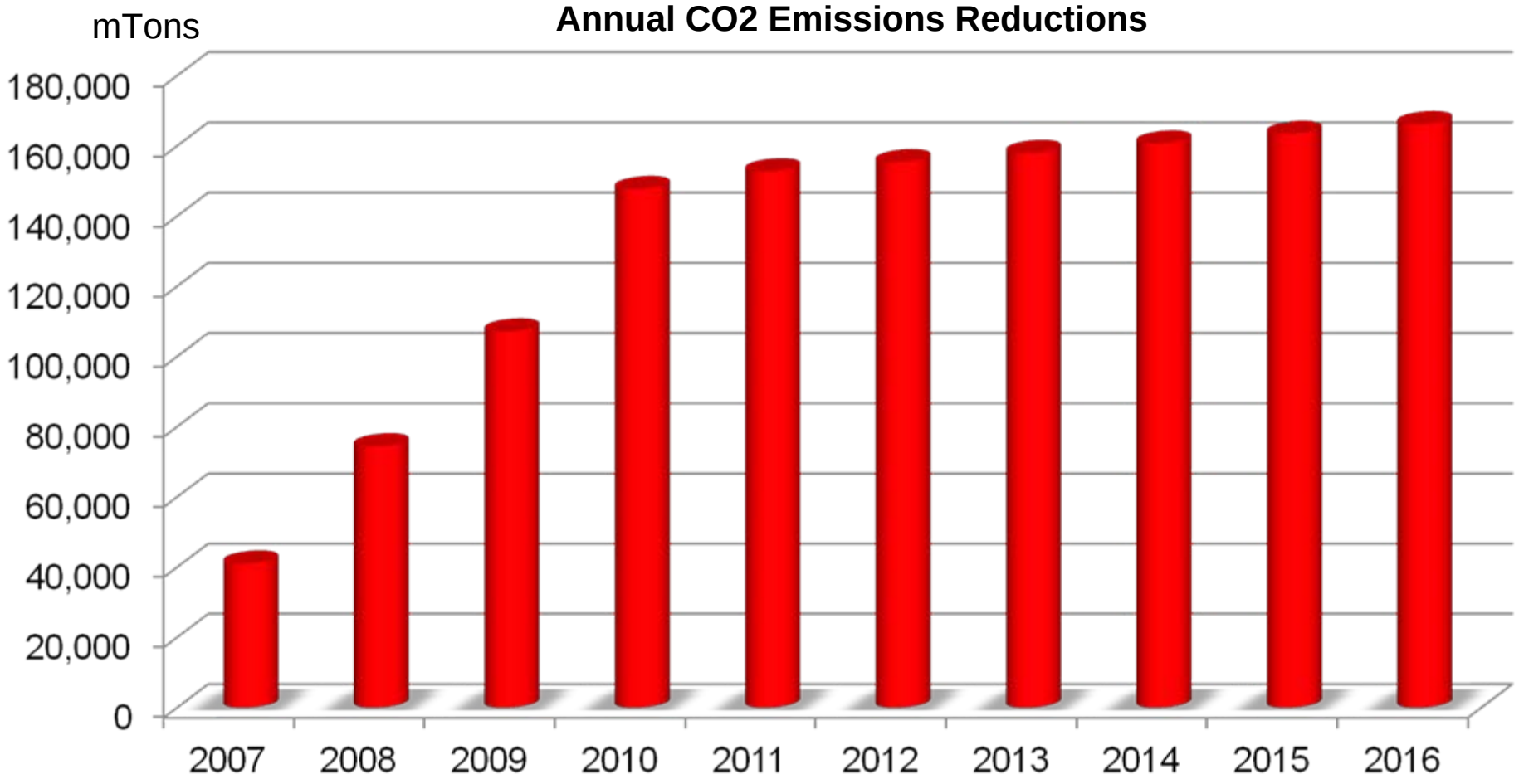
- **Connecticut**



  - Separate Efficiency Tier ~ Class III REC
  - ACP = $31/EEC (1 MWh = EEC)
  - CHP and Conservation projects eligible
  - Requirements 1% in 2007 ~ 4% in 2010 & beyond
  - Formal M&V application process + Revenue Metering
  - Early Adopters awarded DG Grants $450 ~ $500/kW
  - Over 800% increase in efficiency 60+ new CHP plants
  - Credit surplus by 2009
  - EEC prices ~ $10 ($/MWh)

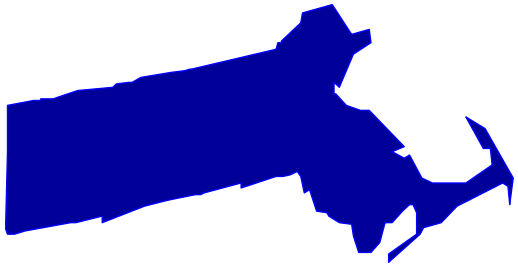
Connecticut CO2 Reductions from EEC Program

- **Over 1.3 million mTons or about ¼ million Cars (10 yrs)**



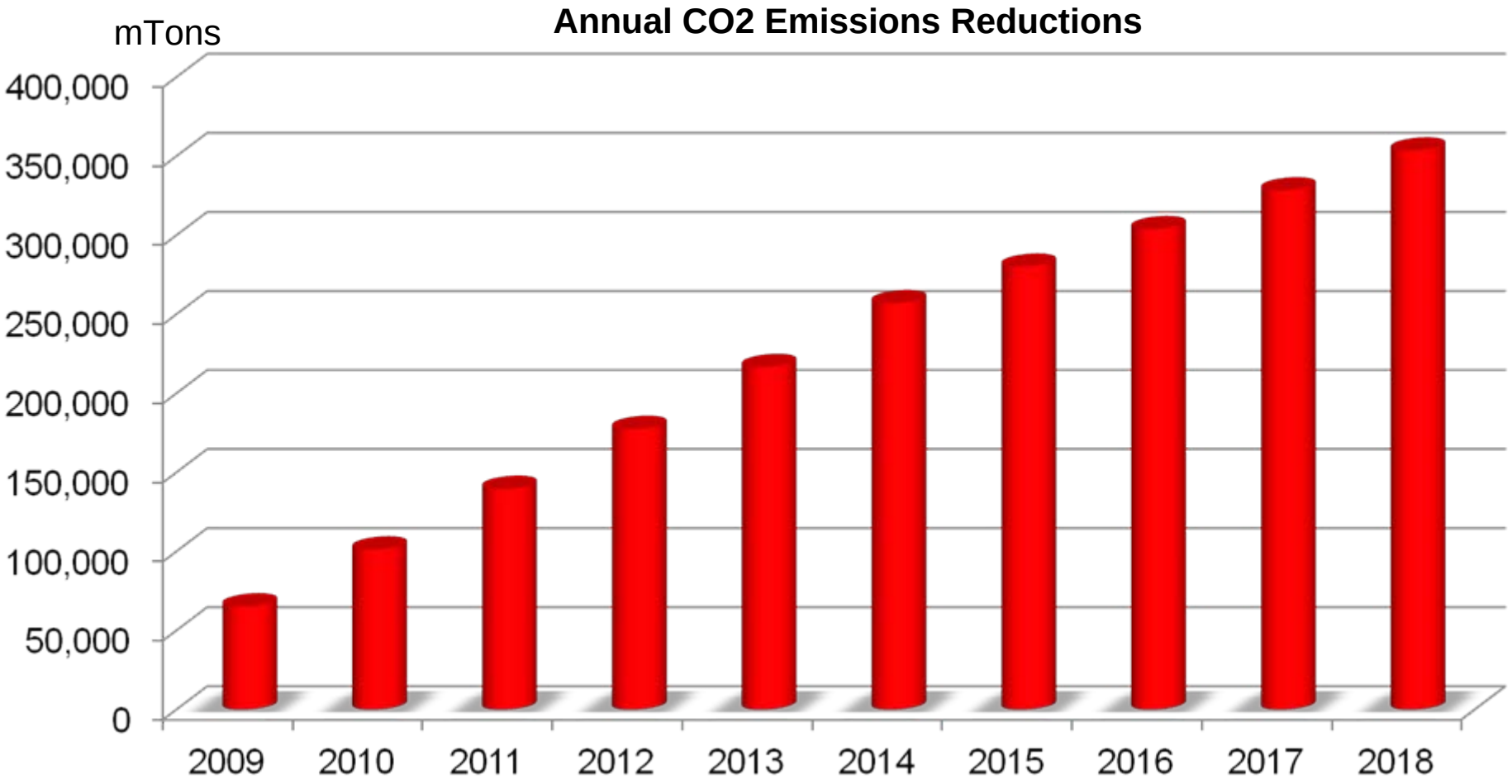
State Programs

- **Massachusetts**
  - "Green Communities Act" – Emissions driven
  - Separate Efficiency Tier ~ APS
  - CHP and Flywheel Storage (+)
  - ACP = $20 (CPI Inflation)
  - EEC formula promotes higher efficiency projects
  - Requirements ½% in 2009, increasing ½% per year
  - Installation Grants up to $750/kW from Utilities
  - Over two dozen new CHP plants in first 2 years
  - EEC prices ~ high teens ($/MWh)

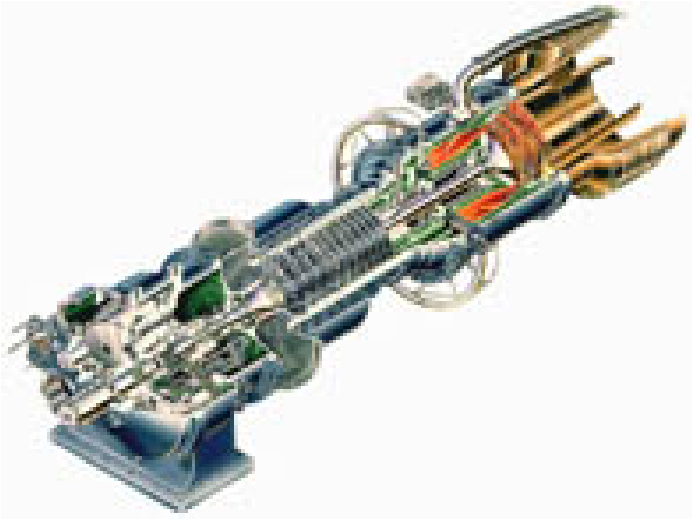


Massachusetts CO2 Reductions from EEC Program

- **Over 2.2 million mTons or about 400,000 Cars (10 yrs)**



Energy Efficiency Project Examples

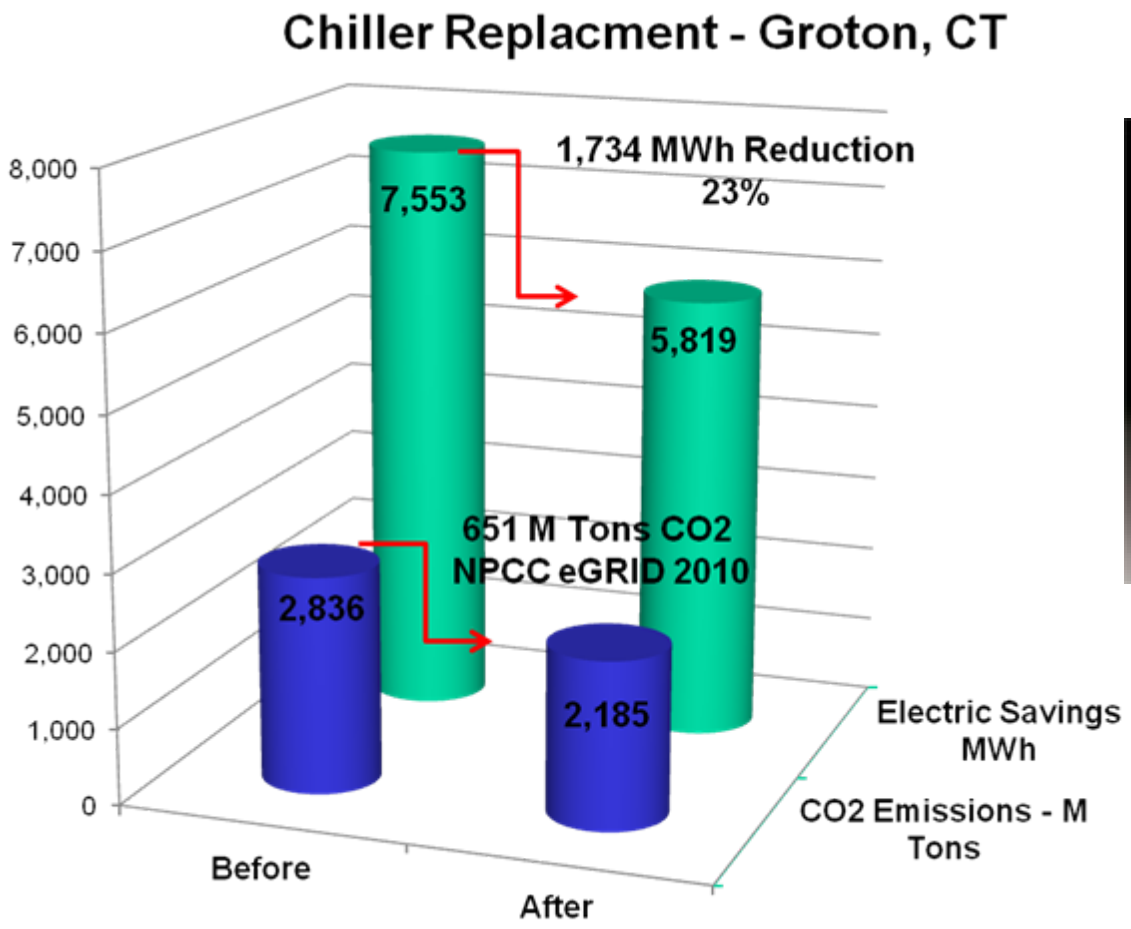


Chiller Replacement – Groton CT

- **4 Centrifugal Chillers generating 3,800 RT @ 0.8 kW/t**
- **Replaced with 4 Centrifugal Chillers generating 4,200 RT @ 0.6 kW/t**

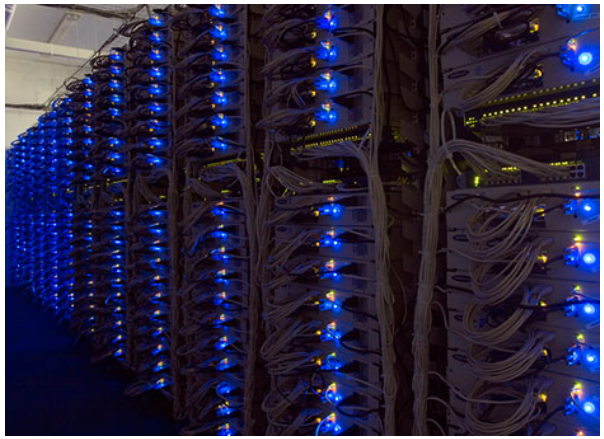
- **1,734 MWhr Electric Savings Annually**
  - 651 MT CO2
  - 2 MT SO2
  - 1 MT NOx.
- **CT Class III RECs x $10 ea. = $17,340**

Chiller Replacement – Emissions Impact

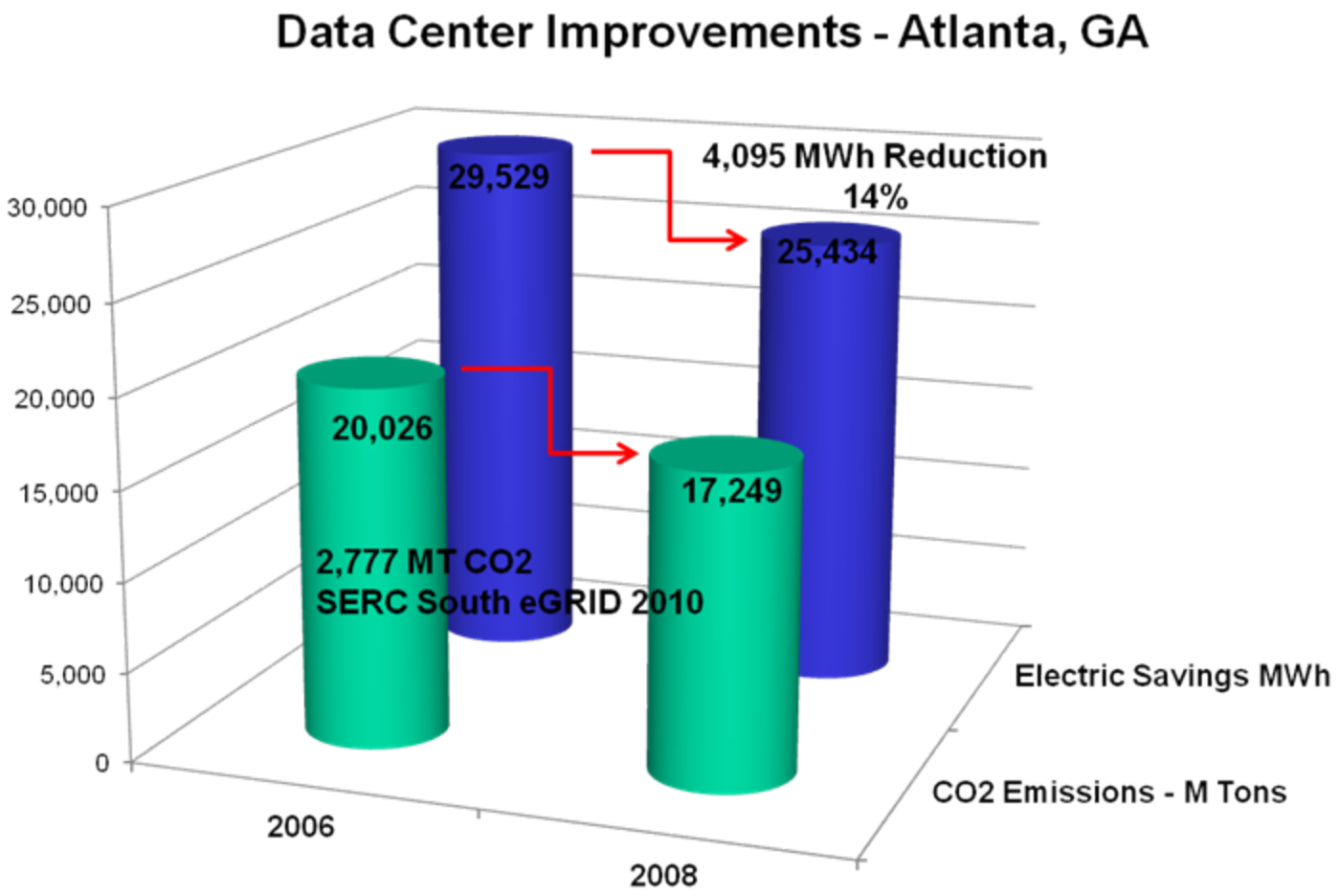


Data Center Improvement – Atlanta, GA

- **175,000 ft² site - Tier IV Facility**
- **ECMs include Equipment & Operations**
  - New Energy Mgt System
  - 1000 ton hour TES
  - 2000 ton hour Waterside Economizer
  - Sealing under floor air leaks (CRAH)
  - Increased chilled water temperature Summer & Winter
  - Eliminate electric humidifiers (dew point improvement)
  - Reduced number of CRAH units to cool the space
- **Annual Savings of 4,095 MWhr**
- **Voluntary EEC's (Georgia) $0.75/MWh = $3,071**



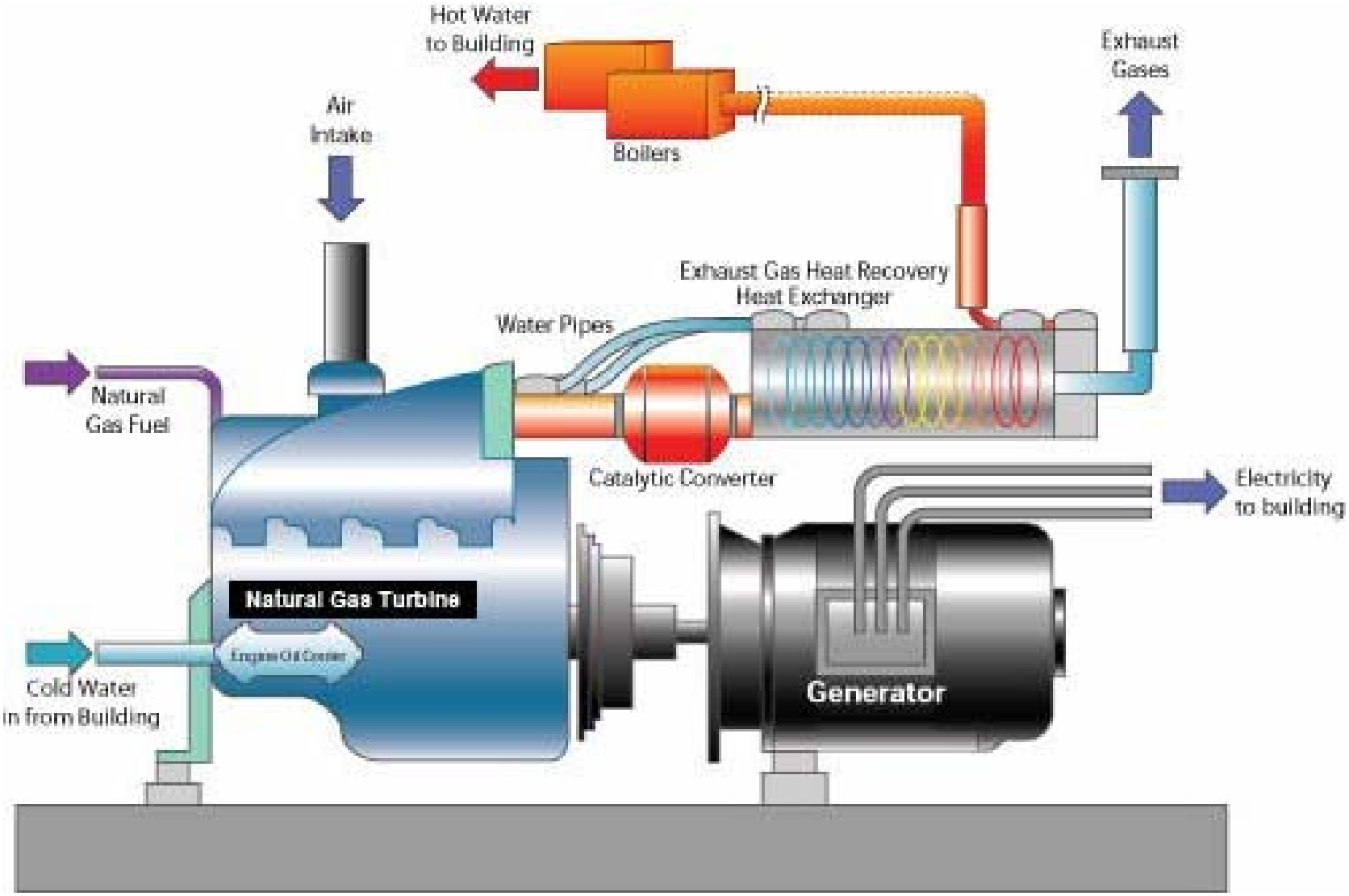
Data Center Improvement – Emissions Impact



New CHP – Boston, MA

- **Opportunity**
  - 7 MW Electric Load – 61,000 MWh annually
  - 25 MMBTU Steam Load – 225,000 MMBTU annually
  - 24 x 7 manufacturing operations
  - Purchased Electricity @ $120 / MWh
  - #2 Oil fired Boilers
  - Lower total energy costs and reduce GHG + Air Pollution
- **Recommendation – Energy Efficiency Improvement**
  - Incorporate CHP
  - Gas fired Turbine + HRSG – "GTCHP"
  - Establish Firm Natural Gas Supply Contract
  - Include Revenue Quality Metering (Fuel, Electric, BTU)
  - Register under Massachusetts APS Program

New CHP – Diagram

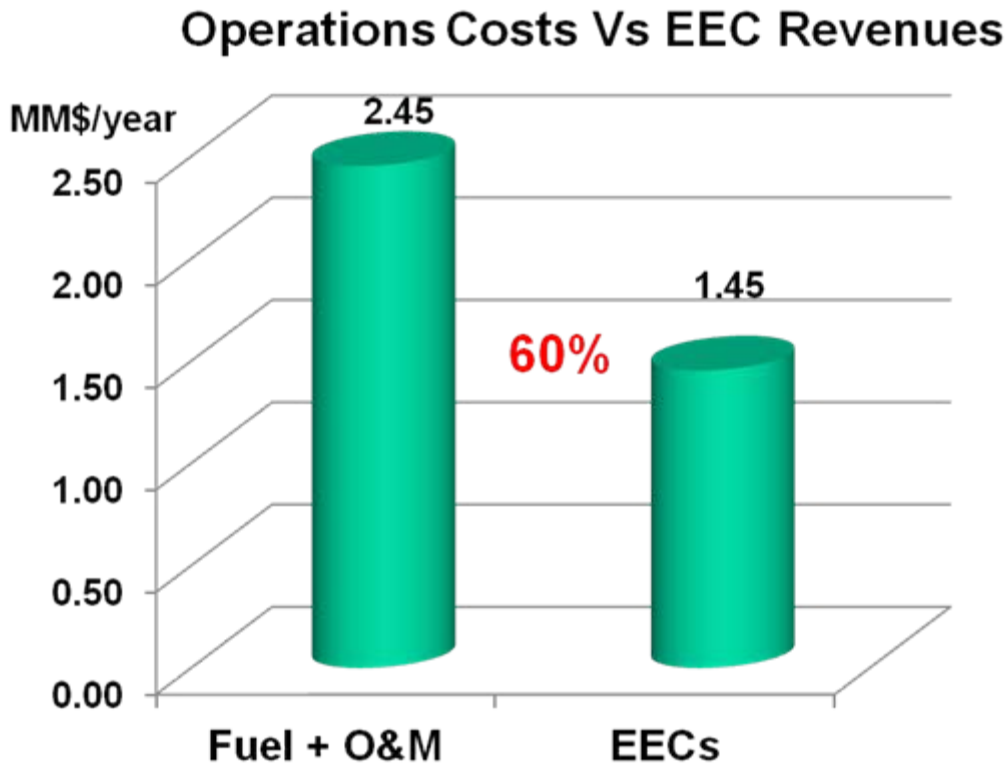


New CHP – System

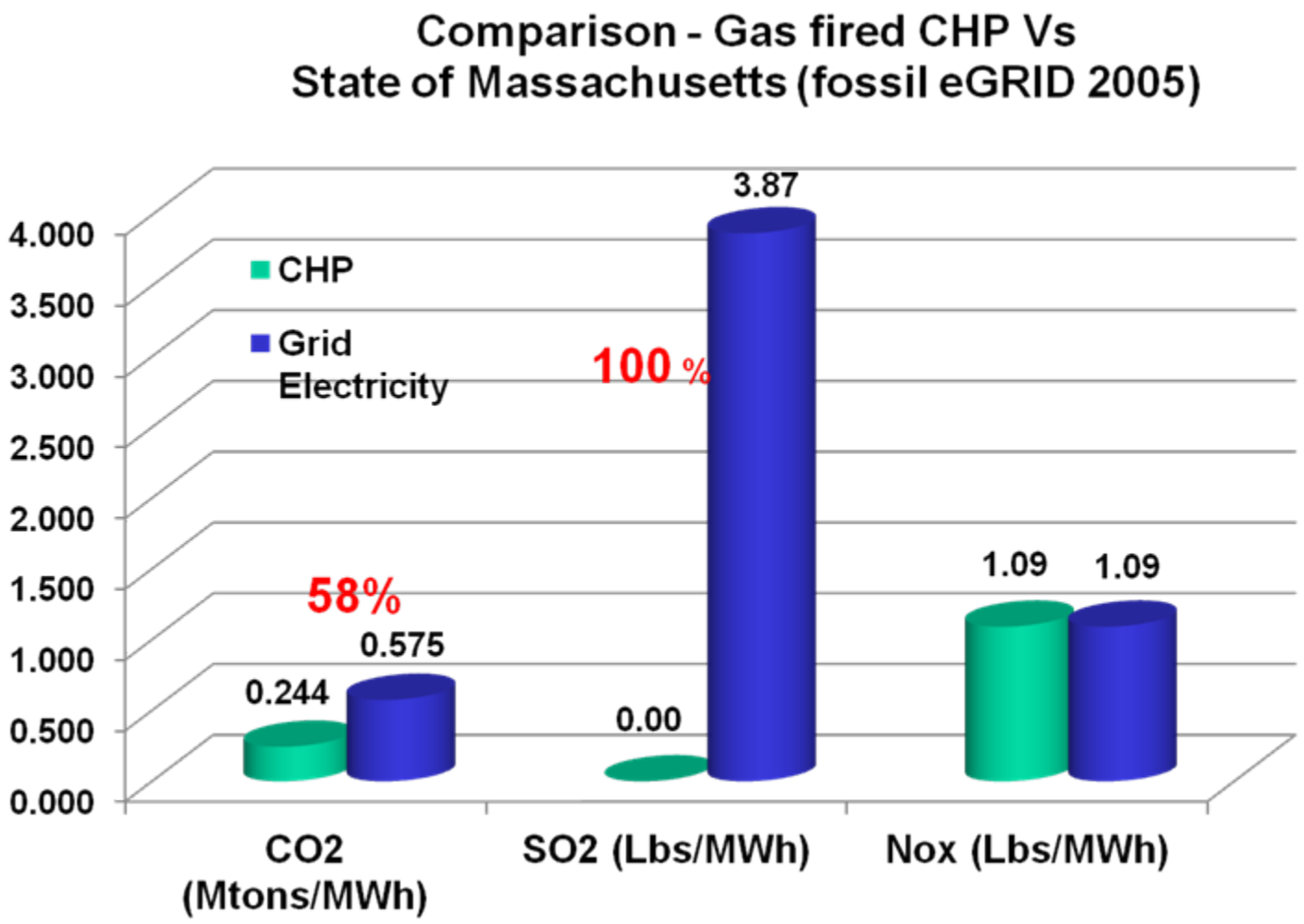
- **Solution – 5 MW Gas fired Turbine + OTSG**
  - 31% Electric Efficiency (HHV) - 11 MMBTU/MWh
  - 70% Thermal Efficiency – WO Duct Firing
  - 79% Overall Fuel Efficiency
  - Fuel Charged to Power (FCP) – 4.6 MMBTU/MWh
  - Heat to Power Ratio – 1.6 : 1
  - Annual operating hours – 8,300 (95%)
  - 41,500 MWhe (70% of existing load)
  - 64,660 MWhth (100% of existing load)
  - Cost to Generate + O&M - $59 / MWh - $2.53 million/ yr
  - Generate 72,700 AECs - $1.45 million/yr
  - 2.5 yr payback

New CHP - Economics

- **Utility Electricity Purchase = 12 ¢/kWh**
- **CHP Generation Cost = 5.9 ¢/kWh (3.9¢ fuel + 2¢ O&M)**
- **EECs ~ 2 ¢/kWh**

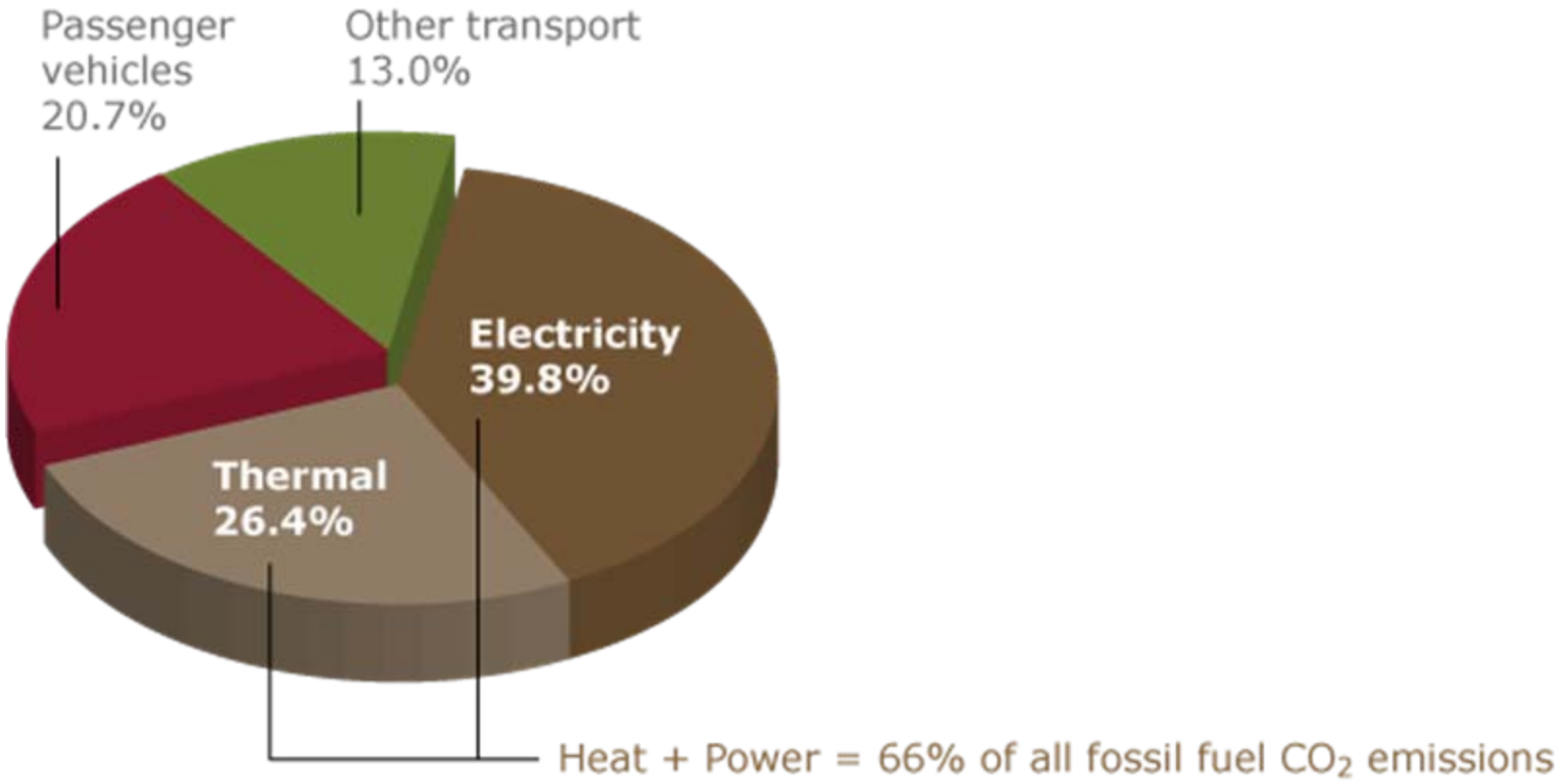


New CHP – Emissions Impact



United States CO2 Source Emissions

- **66% of US GHG emissions comes from heat & power production**



  - Data from US EIA & US DOT

Summary

- **Efficiency gains in chilled water systems will reduce GHG emissions and air pollution. Are typically capital intensive. EECs can improve ROI 20 ~ 35%**
- **Data Centers are energy intense facilities. Operational changes within supporting infrastructure can yield significant electric and emissions savings without major capital costs. EECs could provide 25% increase in ROI & encourage more work.**
- **The overall fuel efficiency gains from combined heat and power (CHP) can provide substantial GHG emissions & air pollution reductions when fired from clean natural gas.**
- **While CHP is capital intensive, when properly sized to the load profile, paybacks in 2 ~ 4 years are typical. EECs leverage private capital by improving ROI 20 ~ 35%.**

Conclusion

EEC Programs Create Significant CO2 Savings

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