

# STATEWIDE EMISSIONS REDUCTION, ELECTRICITY AND DEMAND SAVINGS FROM THE IMPLEMENTATION OF BUILDING-ENERGY-CODES IN TEXAS

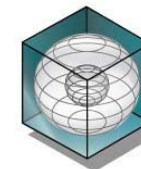
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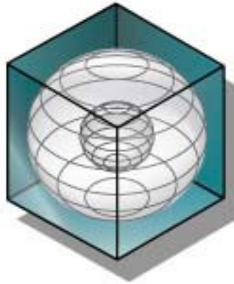
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*12<sup>th</sup> International Conference for Enhanced Building Operations  
Manchester, UK, Oct 23-26, 2012*



Energy Systems Laboratory



Texas A&M Engineering Experiment Station



The Texas A&M University System

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# Energy Systems Laboratory (ESL)

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**The Energy Systems Laboratory (ESL) conducts research and deploys a wide variety of energy efficient and renewable technologies to meet the needs of clients worldwide.**

- **Continuous Commissioning® (CC®)**
  - Improves comfort and increases energy efficiency in existing buildings
  - Optimizes facility performance based on current use
  - Implemented in over 300 buildings
- **Industrial Assessment Center (IAC)**
  - 25 years of continuous funding from the DOE
  - Trains undergraduate & graduate students to conduct no-cost energy audits for regional manufacturing facilities
  - Performed over 600 audits
  - Recommendations made of over \$59 million in annual savings
- **Riverside Energy Efficiency Laboratory (REEL)**
  - The official testing laboratory for the Home Ventilating Institute
  - An ISO 17025 (Laboratory Quality) certified laboratory
  - Serves global HVAC manufacturers
- **Texas Emissions Reduction Plan (TERP)**
  - Assists the state in calculating emissions reduction benefits and in implementation of building energy standards
  - Dedicated to building energy modeling; building energy efficiency; review, assistance and training of energy codes; emissions reduction
  - Developed the International Code Compliance Calculator (IC3), an online energy-performance software tool
  - Produced over 4,000 publications

# Texas Emissions Reduction Plan (TERP)

- **In 2001, the 77th Texas Legislature passed Senate Bill 5 (SB5) defining the Texas Emissions Reduction Plan (TERP)**
  
- **The TERP Objectives**
  - Ensure that the air in Texas meets the Federal Clean Air Act requirements (US EPA Page)
  - Designated 43 counties as non-attainment and near non-attainment
  - Reduce Nitrous Oxides (aka NO<sub>x</sub>) emissions in non-attainment and near-non-attainment counties through mandatory and voluntary programs, including the implementation of energy efficiency and renewable energy programs (EE/RE)

# Texas Emissions Reduction Plan (TERP)

## ■ **TERP Key Provisions**

- A diesel emissions reduction incentive program
- A motor vehicle purchase or lease incentive program
- A new technology research and development program
- An energy efficiency grant program
- A statewide Texas Building Energy Performance Standard (TBEPS) for all residential and commercial buildings
- A goal of 5% per year reduction in electrical consumption for facilities of political subdivisions in non-attainment and near-non-attainment counties from 2002 through 2008

## ESL's Role in TERP

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- **Analyze the impact of several of the TERP programs for consideration in the State Implementation Plan (SIP).**

### **Programs include:**

- green power purchases, including wind and other renewable energy resources
- the Public Utility Commission of Texas (PUC) energy efficiency programs
- the State Energy Conservation Office (SECO) program for state agencies, political subdivisions and institutions of higher education
- retrofits to federal buildings
- furnace pilot light retrofits
- residential air conditioner retrofits
- residential and commercial construction


- **Analysis focuses on:**

- Energy savings
- Creditable emissions reductions
- Statewide / By county

***ESL has been named  
A National Center of Excellence  
on Displaced Emission  
Reductions for the US EPA***

## ESL's Role in TERP | continued...

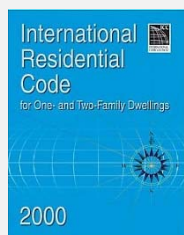
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- **Provide statewide building energy-code implementation assistance:**
  - Review new building energy code, analyze their stringency and recommending their adoption to the State Energy Conservation Office (SECO) as part of the rule making process
  - Analyze local code amendments for stringency
  - Measure the impacts of energy codes statewide
  - Conduct outreach & provide energy code training to municipal inspectors
  - Provide technical assistance to municipalities, councils of governments and state agencies
  - Developed & regularly upgrade the  , a web-based, code-compliance energy simulation tool, used by builders and building officials statewide

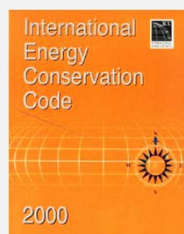
# Texas Building Energy Performance Standards (TBEPS)

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In 2001, the **Texas Building Energy Performance Standards (TBEPS)** were set:



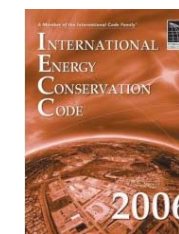
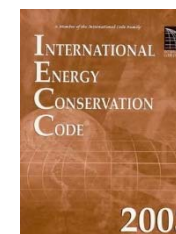
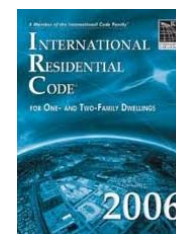
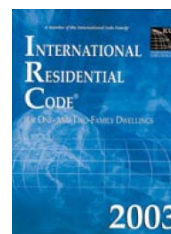
*2000 IRC, EE Chapter:*  
For single-family residences



*2000 IECC w/2001 Supplement:*  
For commercial, industrial & residential over three stories

During **2002-2009**, newer versions of IRC & IECC have been published.

- ESL reviewed their stringency
- Texas did not update the TBEPS
- Some jurisdictions adopted the newer codes



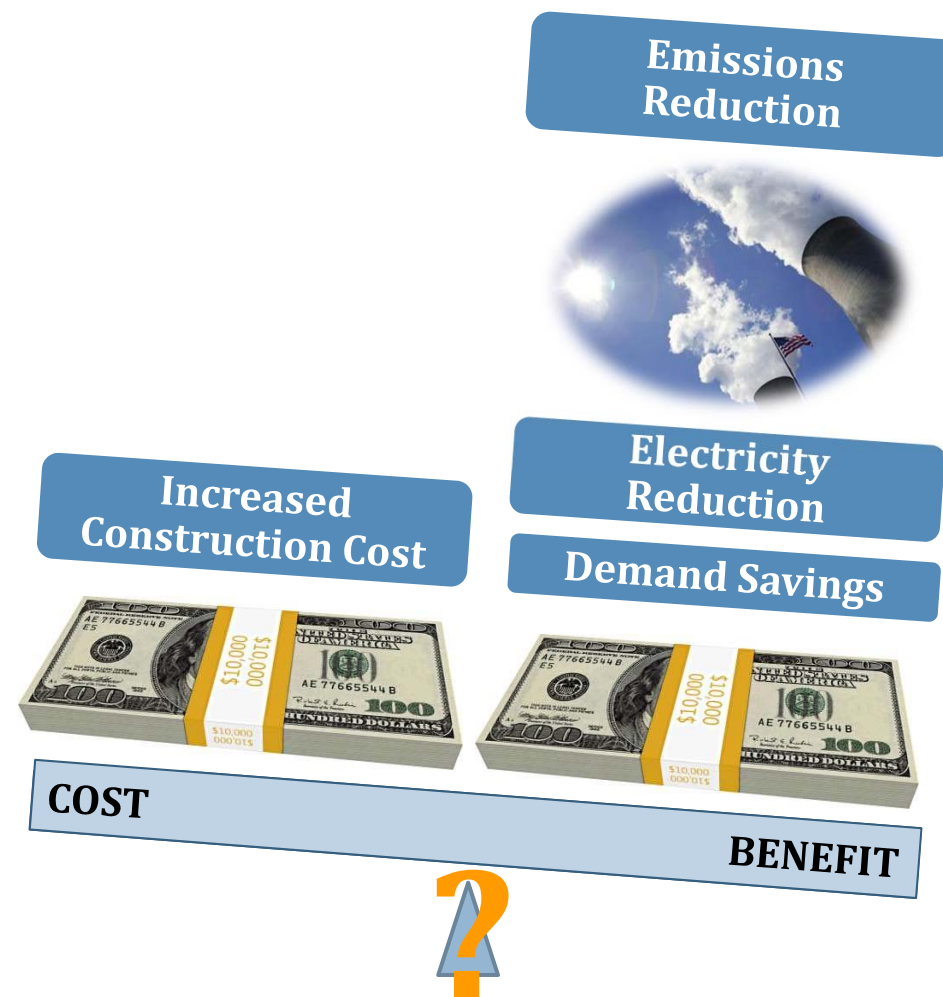


# This Paper

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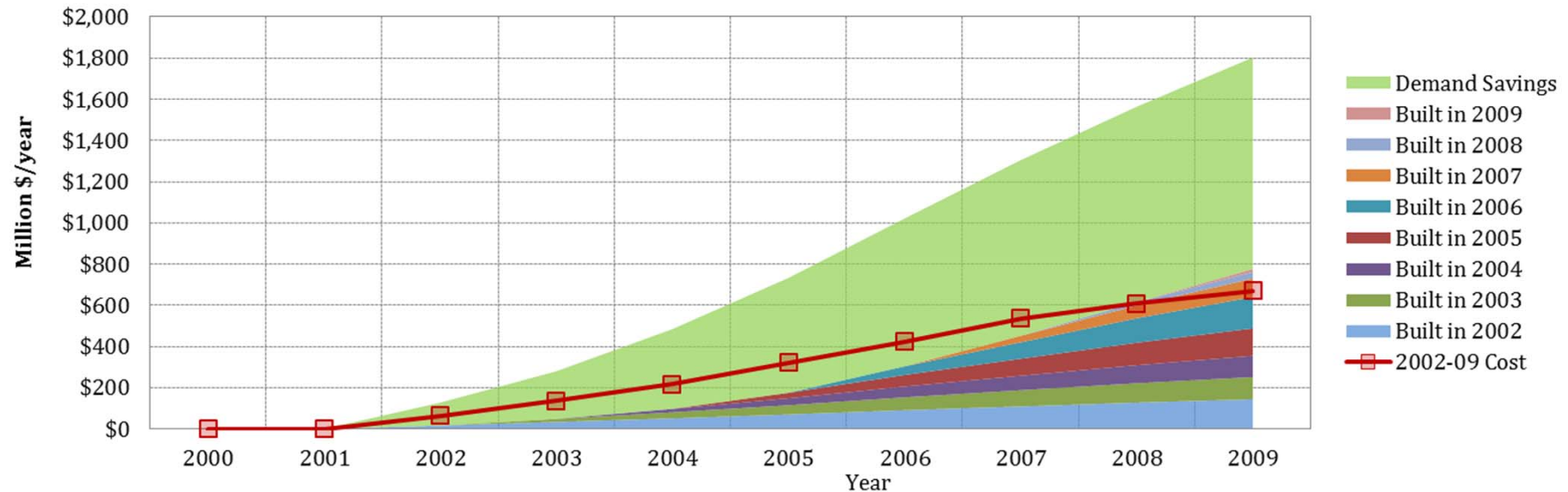
## This paper focuses on:

- Estimates of **electricity reduction** and **electric demand savings** from the adoption of energy codes for single-family residences in Texas, 2002-2009
- Corresponding **increase in construction costs**
- Estimates of the statewide **emissions reduction**



# Results: Statewide Electricity & Cost Savings

## Cumulative Increased Costs, Statewide Electricity Savings, and Electric Demand Savings Associated with the Adoption of Energy Codes for New Single-Family Residences in Texas: 2002-2009



|                        | Electricity savings | Electric demand savings   | Total Savings                                       | Increased construction costs |
|------------------------|---------------------|---|---|------------------------------|
| Statewide (2002 -2009) | \$776 million       | \$929 million OR (summer reductions)<br>\$1,027 million (winter reductions) | <b>\$1,705 million OR</b><br><b>\$1,803 million</b> | <b>\$670 million</b>         |

# Results: Building Level - Electricity & Cost Savings

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## A typical Single-Family Residence in Texas

|           | Electricity savings | Electric demand savings                            | Increased construction costs |
|-----------|---------------------|--|------------------------------|
| 2001 IECC | \$111 ~ \$313       | 0 ~ 0.6 kW for summer<br>2.4 ~ 4 kW for winter     | \$600 ~ \$1215               |
| 2006 IECC | \$424 ~ \$838       | 1.9 ~ 2.0 kW for summer<br>3.5 ~ 5.6 kW for winter | \$902 ~ \$1,744              |

## Results: Statewide Emissions Reduction

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### The **Annual & Ozone Season Day (OSD) Emissions Reduction** from Energy Code-Compliant Single Family Construction in Texas

|                           | Annual emissions reduction   | Equivalent to...                                       | OSD emissions reduction  |
|---------------------------|--|--|--|
| Statewide<br>(2002 -2009) | 4,112 (Tons NO <sub>x</sub> /yr)<br>= <b>8.6%</b> of the impact of all<br>TERP stationary programs | <b>~215,300 cars taken off<br/>the road for 1 year</b> | 22.58 (Tons NO <sub>x</sub> /day)<br>= <b>17%</b> of the impact of all<br>TERP stationary programs |

# Acknowledgement

Funding for this study was provided by the Texas State Legislature through the Texas Emissions Reduction Plan (TERP).

**Thank You!**

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