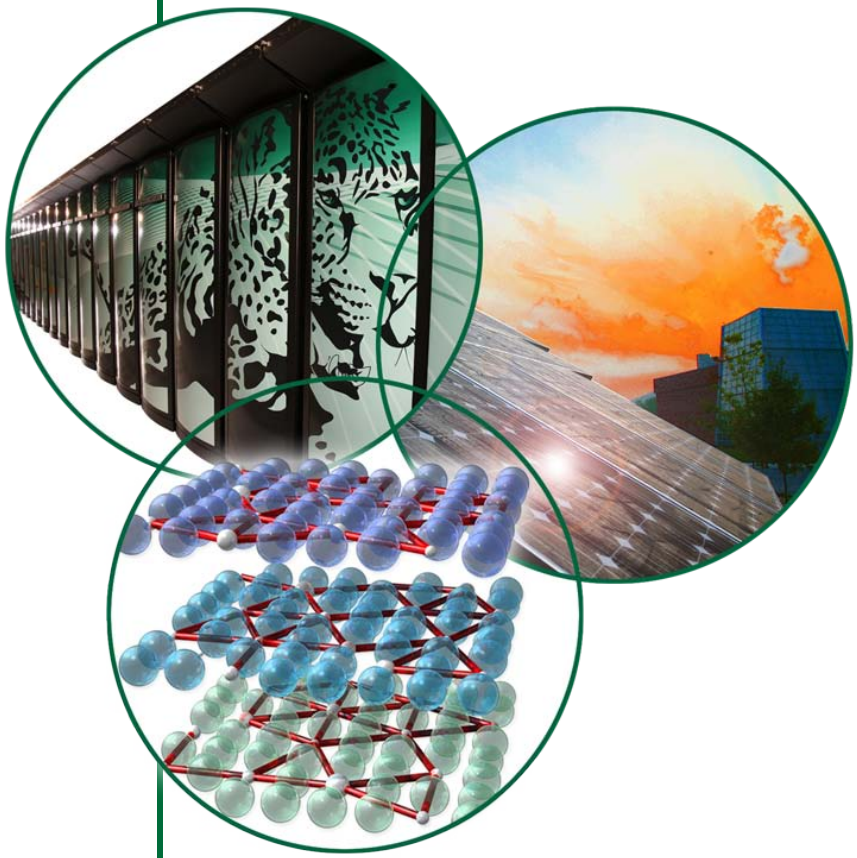
Load Projection Studies for ERCOT

Stanton W. Hadley

Oak Ridge National Laboratory

August 20, 2010



U.S. DEPARTMENT OF ENERGY

OAK RIDGE NATIONAL LABORATORY

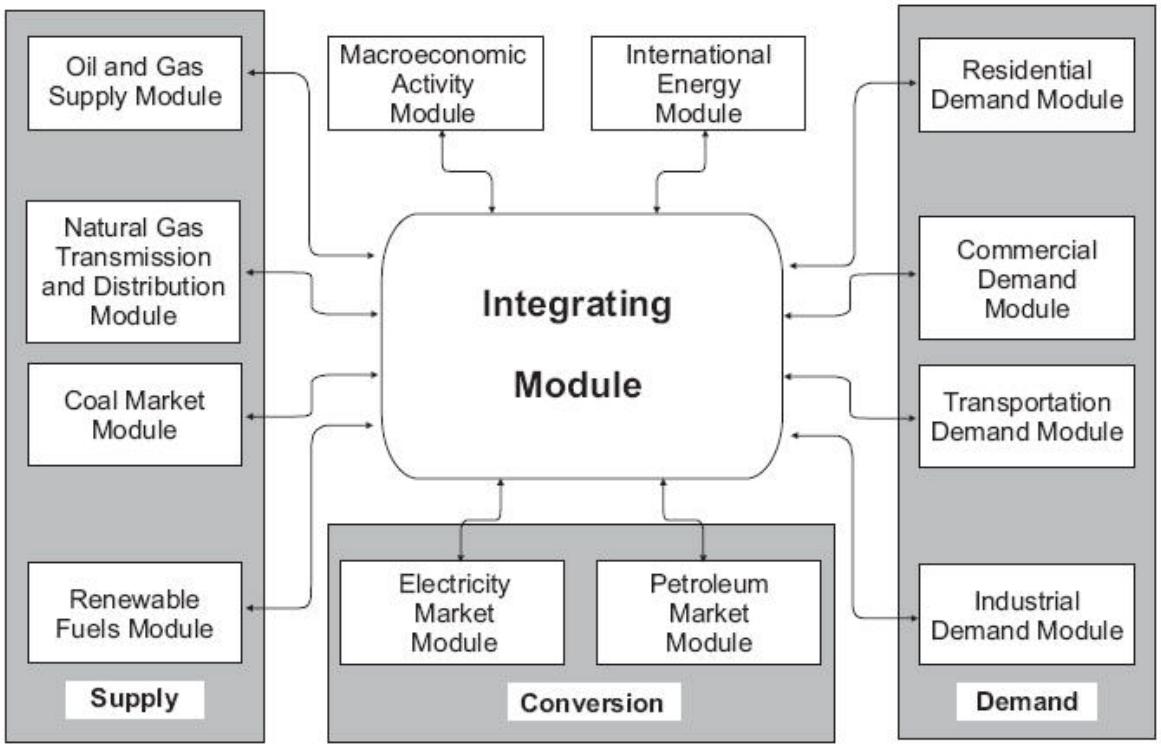
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Outline

- Studies of Demand
  - EIA Analyses
    - Annual Energy Outlook
    - Various Climate Change Proposals
  - Energy Efficiency in the South
    - Meta-review of Other Studies
    - NEMS Analysis of EE Potential Across South
  - Renewable Energy Futures
    - High penetration of renewables by 2050
- Eastern Interconnect Process
- DOE Lab Studies

NEMS model used for several Studies

- National Energy Modeling System (NEMS) developed by Energy Information Administration (EIA) over past 20 years
- Complex program
  - FORTRAN
  - PC-based
  - 8 hours to run

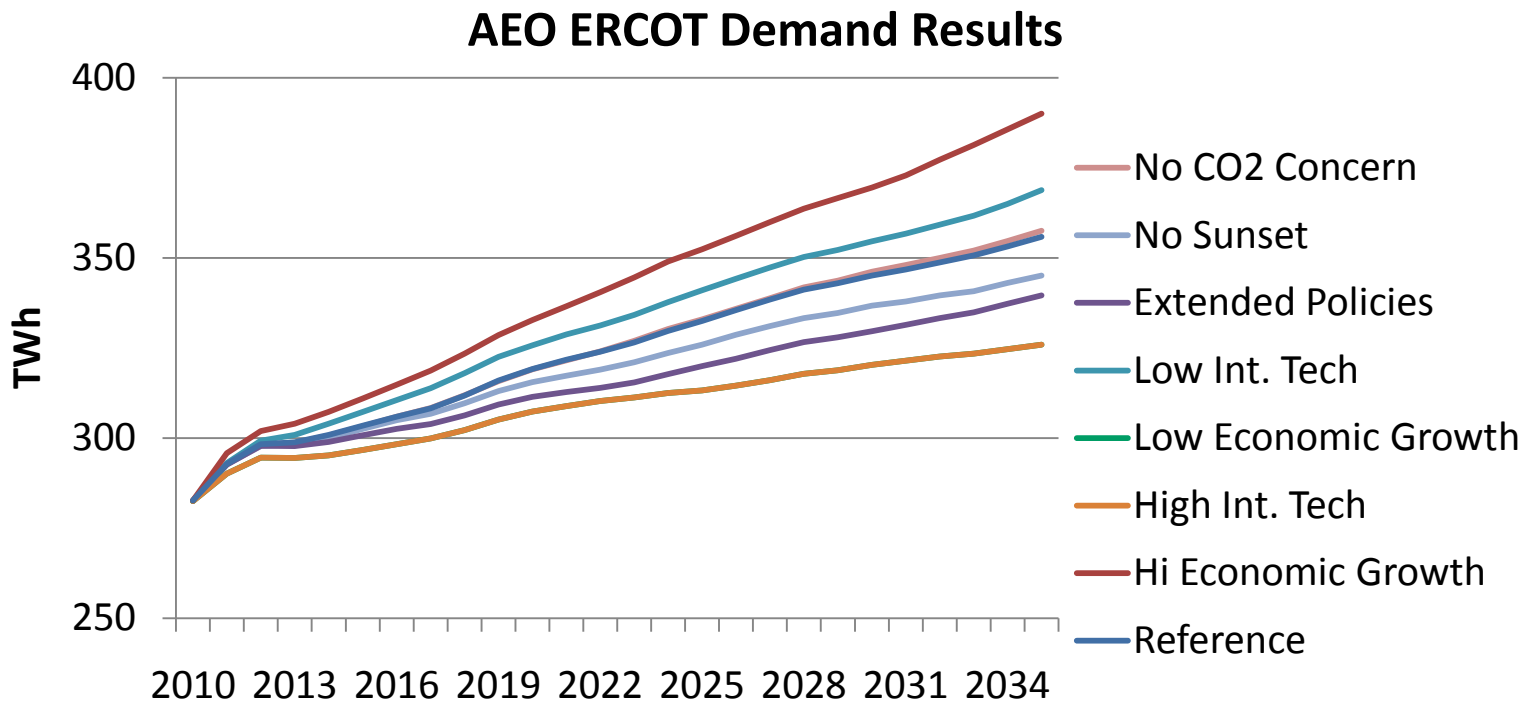


Annual Energy Outlook

- Latest is AEO 2010
- Provides national and regional results
- Reference case plus 30 variations available
  - High & Low Economic Growth
  - High & Low Technology
  - High & Low Coal Cost
  - High & Low Fossil Technology
  - High & Low Nuclear Cost
  - High & Low Renewable Cost
  - High & Low Oil Price
  - Delayed phase-out of policies
  - Misc. Other

ERCOT results

- Demand growth varies between 0.6% and 1.3%
  - Selected cases with demand sensitivity



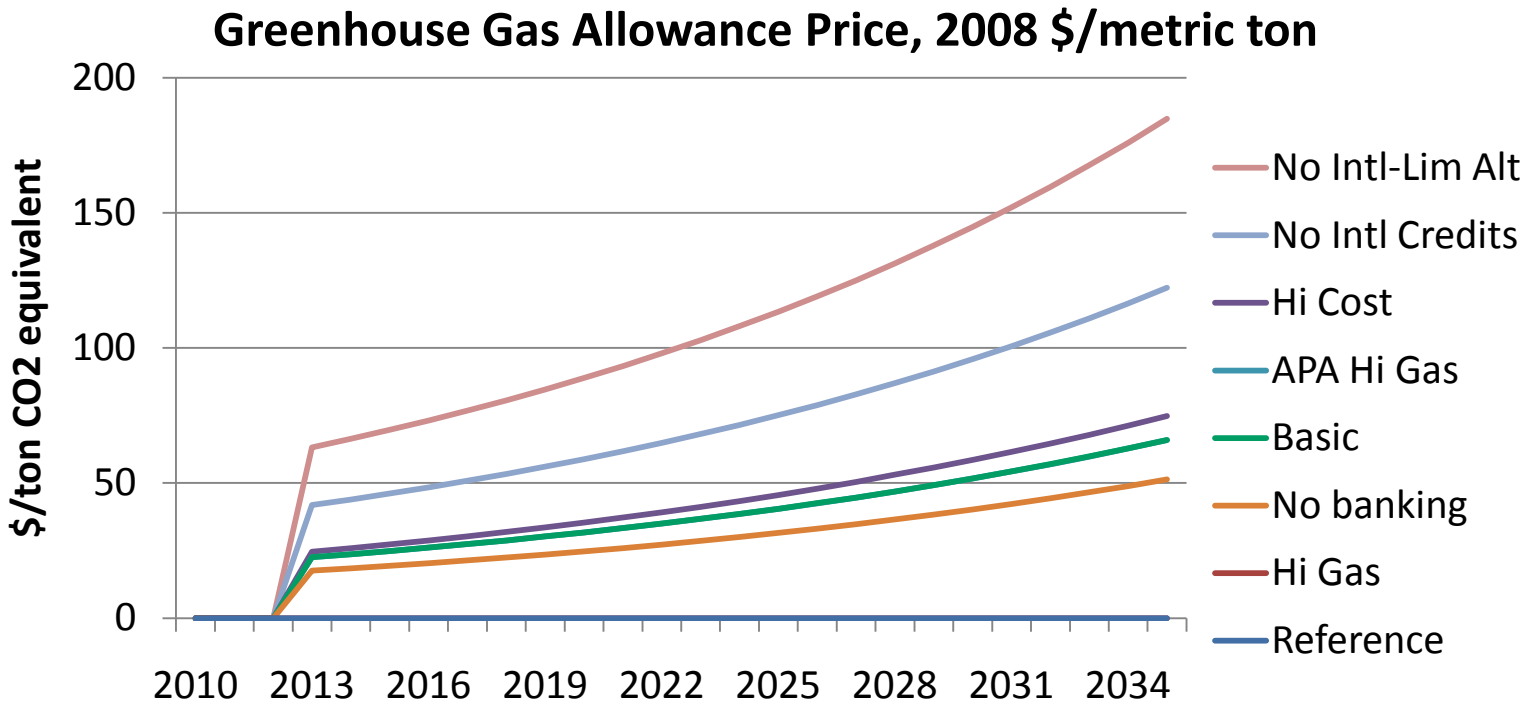
Other Recent EIA Studies

- Kerry-Lieberman (American Power Act)
  - Vary from AEO2010 reference
    - gas resources
    - emission credit availability
    - Technology cost and availability
  - Demand growth changes due to:
    - Energy prices
    - Economic growth changed
    - More efficient equipment purchased
- Waxman Markey (HR2454)
  - Based on AEO2009
  - Similar results

ERCOT Demand Growth Rate 2010-2035	
Reference	0.94%
Hi Gas Resource	1.00%
Basic APA	0.67%
No Banking	0.70%
APA Hi Gas	0.63%
Hi Cost	0.62%
No Intl Credits	0.51%
No Intl-Lim Alt	0.06%

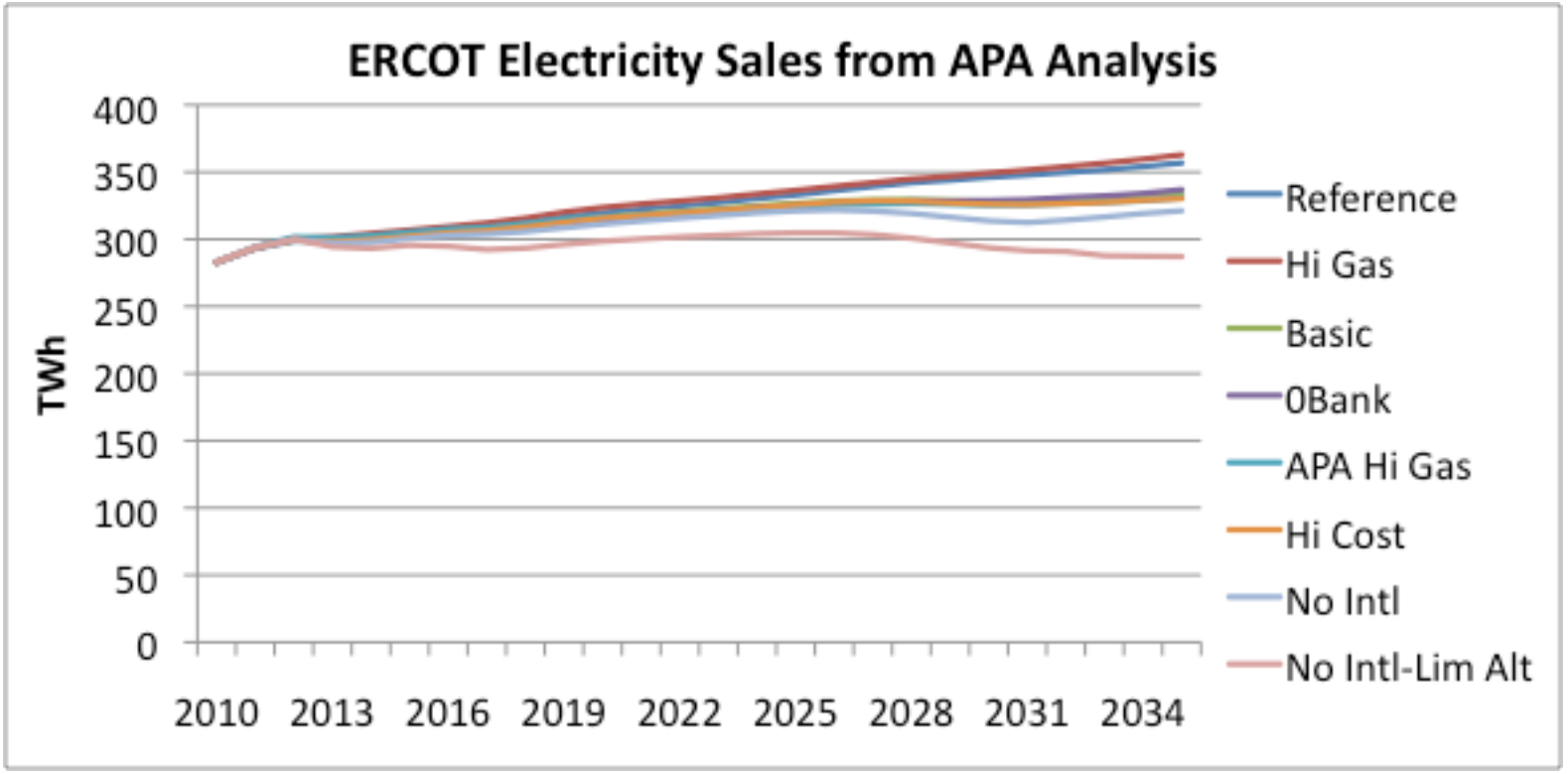
CO2 Allowance Prices

- Range from $51 to $185 with Basic scenario at $66/ton
- In nominal $, prices are $88 to $340 with Basic at $115



ERCOT Demand Data

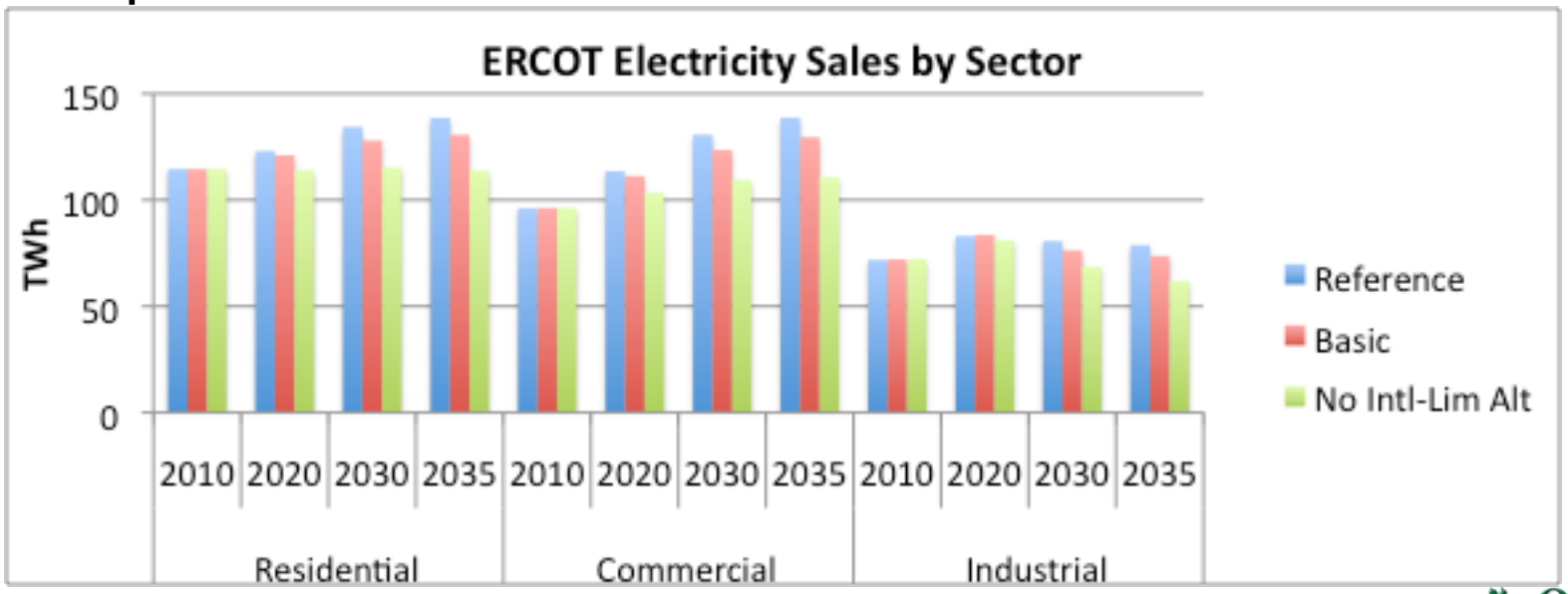
- Lack of International Credits has largest impact
  - Combined with limited alternatives gives lowest demand



Demand Growth by Sector

- NEMS calculates demands for
  - Residential
  - Commercial
  - Industrial
  - Transportation

2010-2035 Growth Rate	Ref	Basic	No Intl - Lim Alt
Residential	0.77%	0.53%	-0.02%
Commercial	1.48%	1.19%	0.56%
Industrial	0.37%	0.09%	-0.62%
Transportation	8.78%	9.23%	9.71%

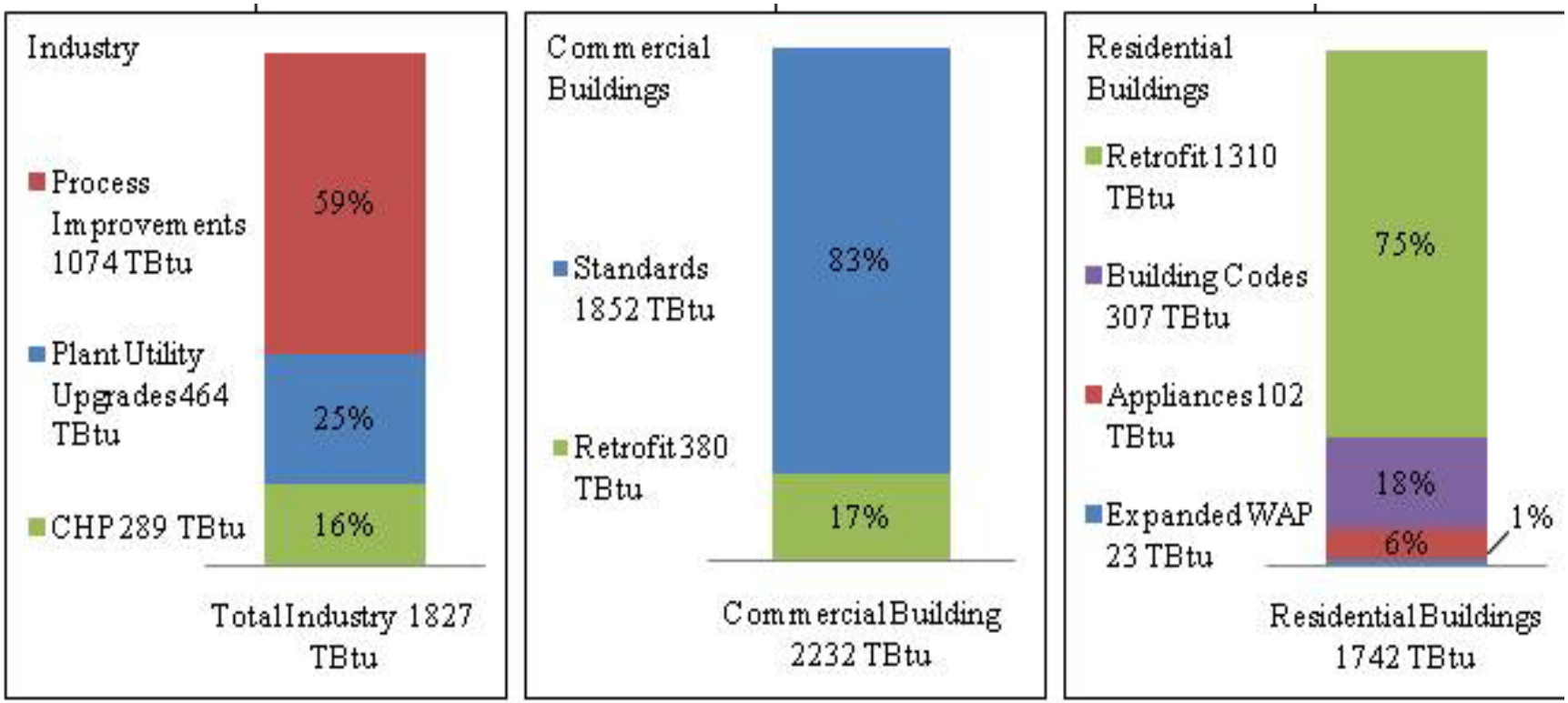


Energy Efficiency in the South

- Georgia Tech/Duke University (ORNL assistance)
- Funded by Energy Foundation
- Fall 2008 – Spring 2010
- Evaluate potential savings from energy efficiency policies
- Studied 20 states in South
- First report was meta-analysis of other studies
- Used NEMS for quantitative analysis through 2030

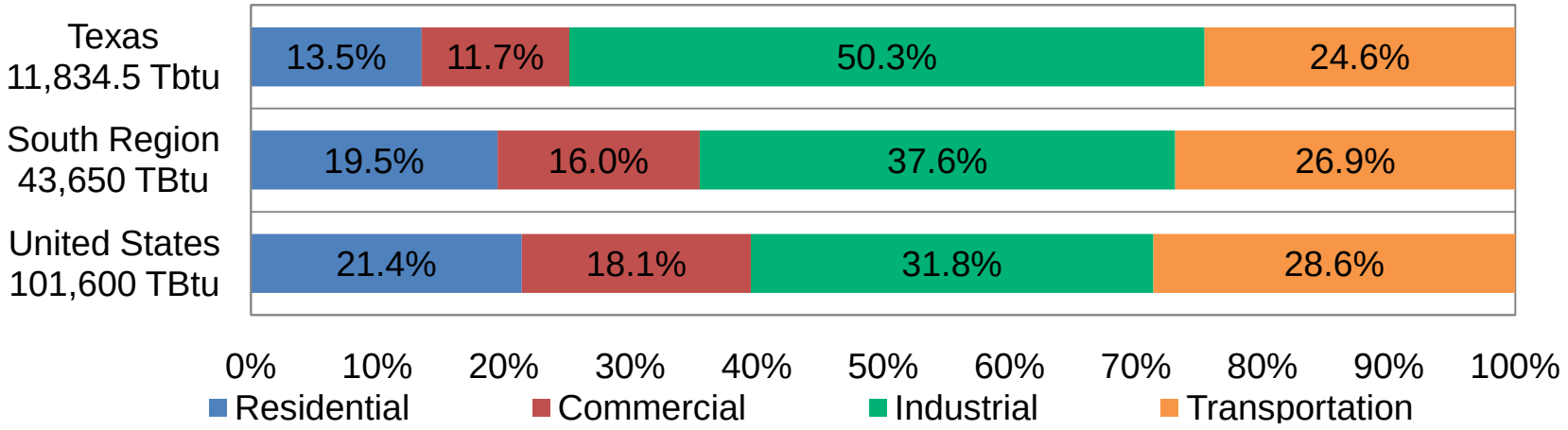
Policies Analyzed

- Nine policies in three main sectors
- Results below are for all of the South (20 states)



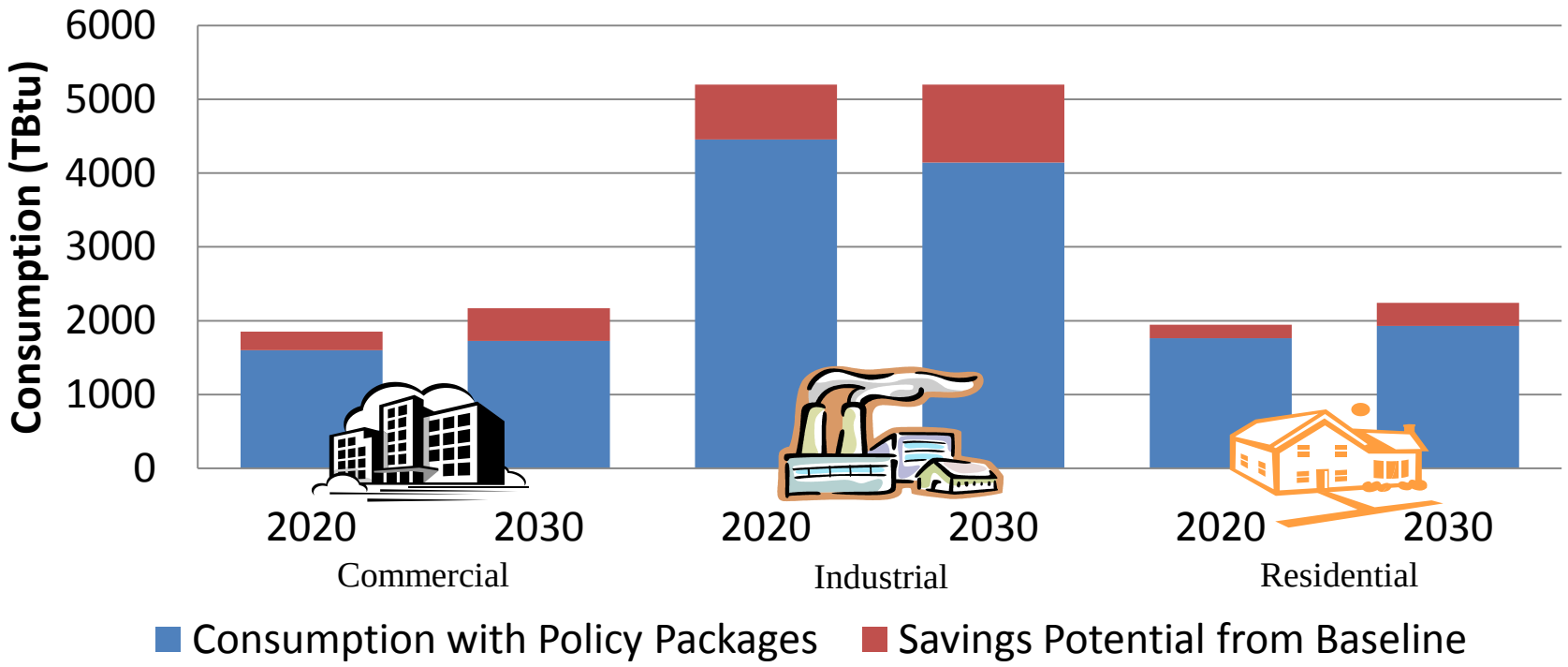
Texas Energy Use in 2007

- Texas has much higher proportion of energy use in industry



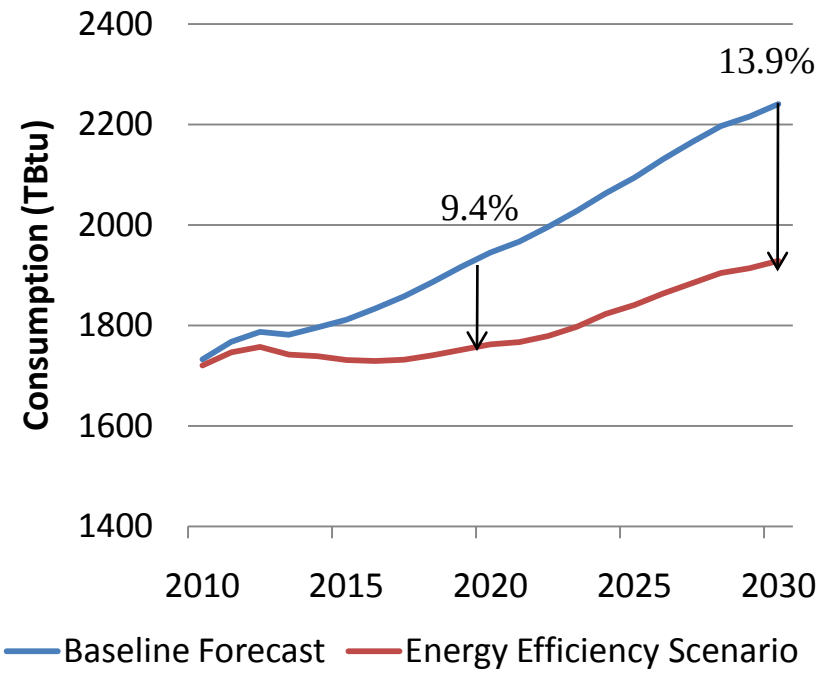
Texas Energy Savings Potential

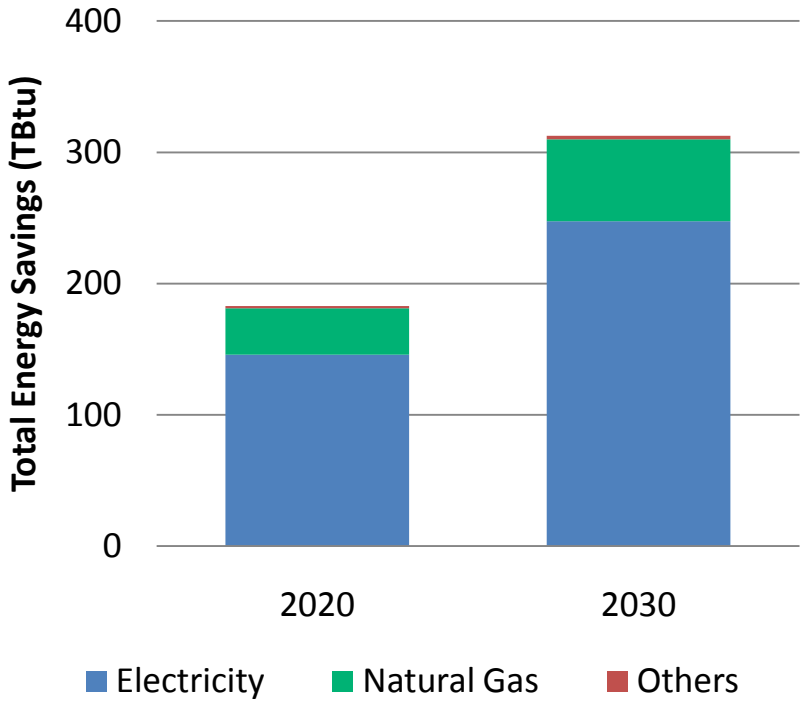
- Metadata Study indicates savings of 5% - 11%
- Quantitative analysis shows potential savings of 15%



Residential Savings

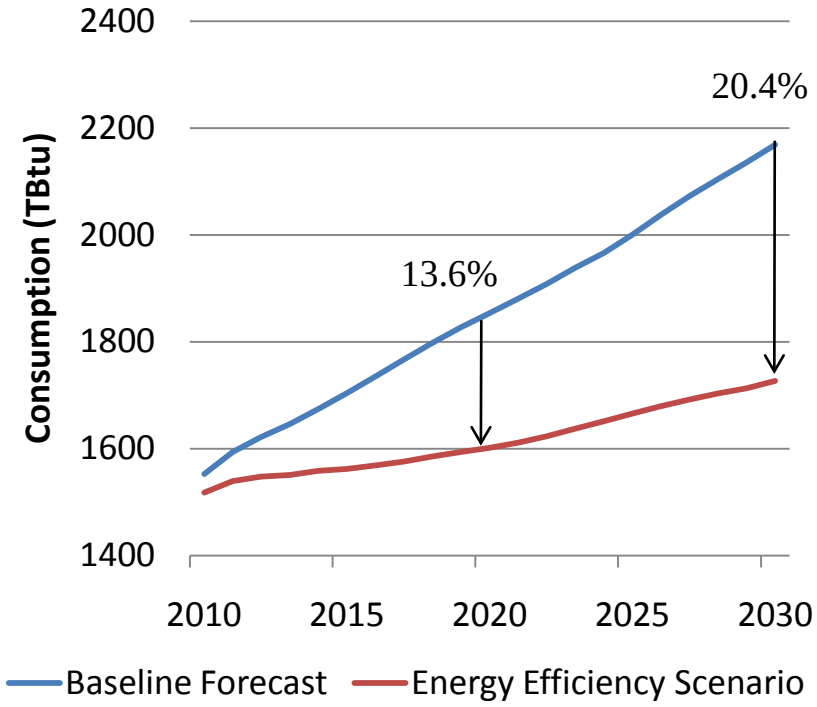
- Savings both in electricity and natural gas

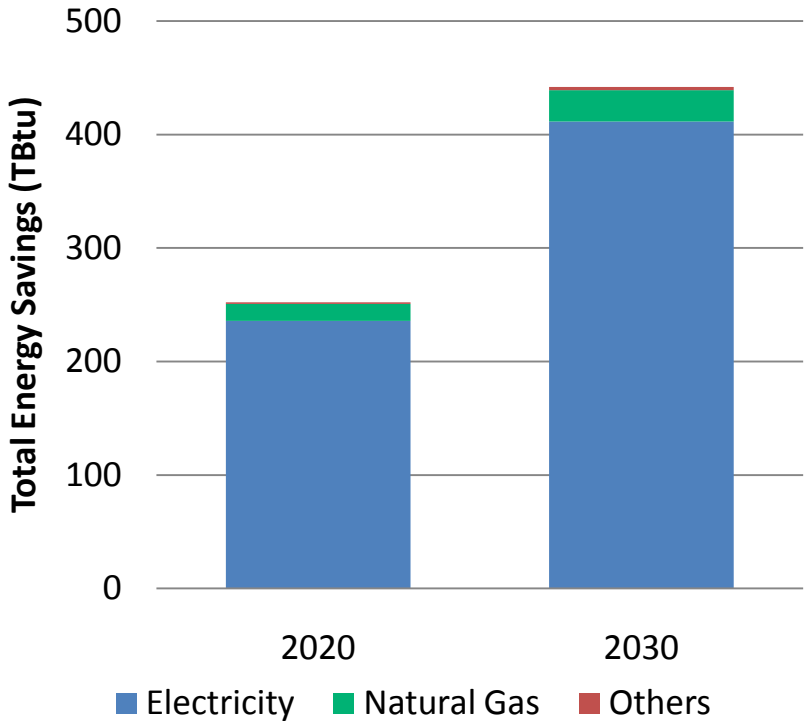




Commercial Potential Savings

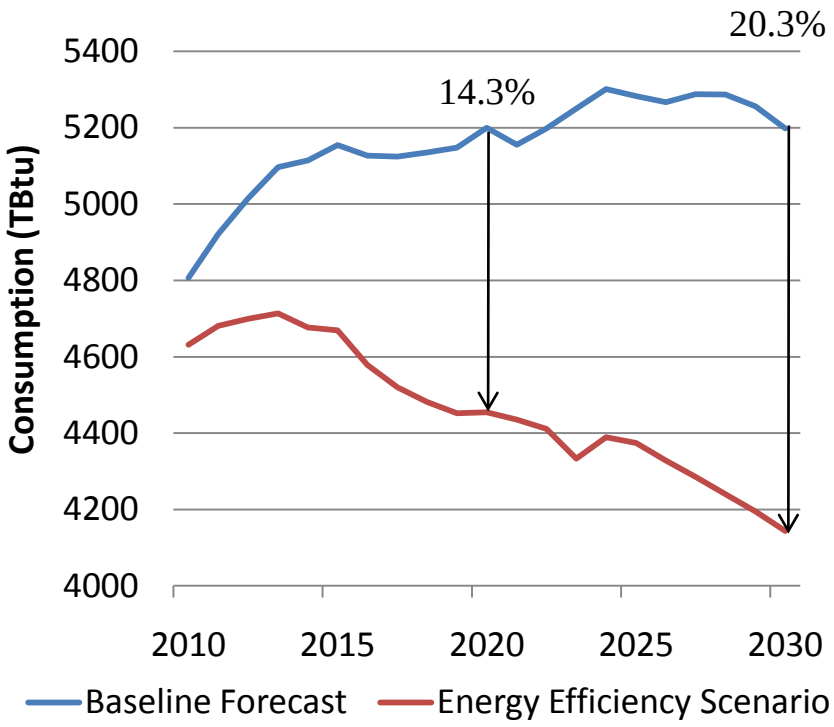
- Savings even higher for Commercial
- Largely electrical

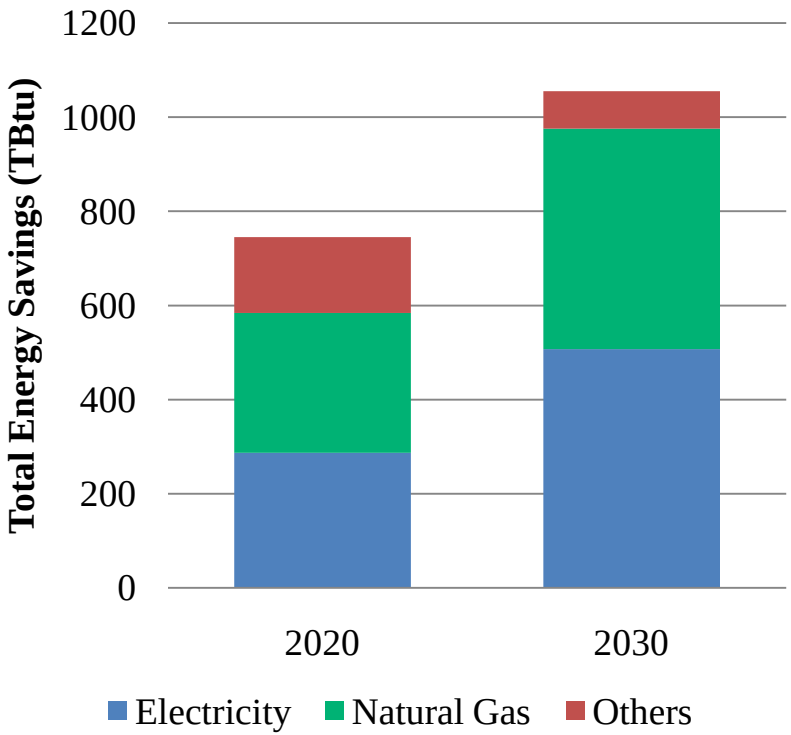




Industrial Potential Savings

- Industrial Savings could reverse growth in demand
- Savings are in multiple fuels





Renewable Energy Futures Study

- What is the impact of a massive push for renewables
  - 80% of electricity from Renewables by 2050
  - Multi-year study with ReEDS model
  - 2050 load flow study with GridView
- Detailed study of different renewable resources
  - Multi-lab plus contractor effort
  - Cost, availability, reliability, technology improvements
  - Sensitivities on multiple criteria
- Two demand scenarios developed for study
- Results are still in draft, under review in September

RE Futures Demand Needs

- ReEDS model needs demand profiles for each of 120+ balancing regions
  - Load curve is aggregated to 16 time periods representing different seasons and times of day
  - 13 NERC regions' data can be allocated to the 120+ regions
  - Curves are needed for every other year 2006-2050
- Gridview needs hourly load data for 2050 for each region
  - Demand profile should correlate to wind profile so both used 2006 as template year

Residential and Commercial Demands

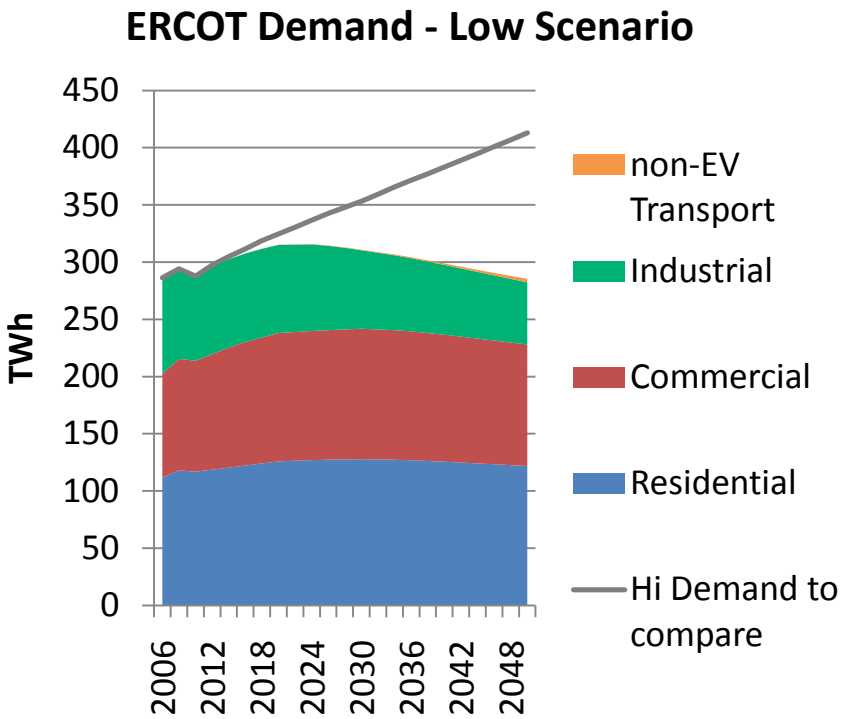
- PNNL generates annual loads for buildings based on two projections for improved energy intensity in new and existing stock, Low and High.
- LBNL generates hourly profiles from NEMS methodology considering building and appliance loads.
  - Create average weekday, weekend, and peak profile for each month and each NERC region for every five years
- ORNL uses 2006 hourly load data for utilities from FERC to adjust average hourly profiles for every year to mimic 2006 hourly load shapes.
- NREL calculates 16-step profiles for each ReEDS region.

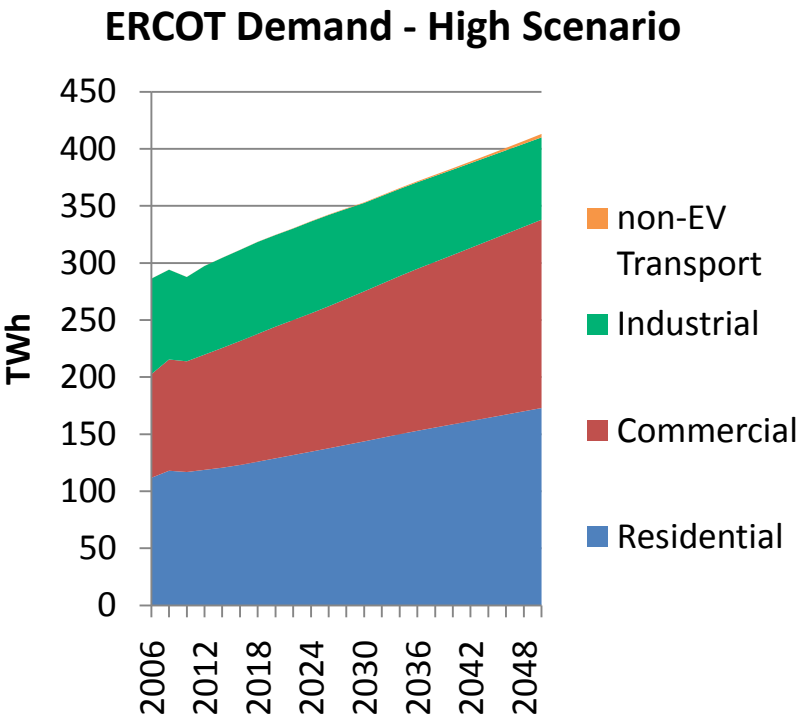
Industrial and Transportation Demand

- ORNL uses demand projections from two NEMS runs
  - AEO2009 including stimulus funds and impacts for high demand
  - Simulation of Waxman-Markey Bill for low demand
- Industrial load factor estimates from EPRI convert electricity demand (TWh) to peak load demand (MW)
- NREL calculates PHEV demand profiles based on assumptions on fleet growth and hourly charging patterns

ERCOT Demands 2006-2050

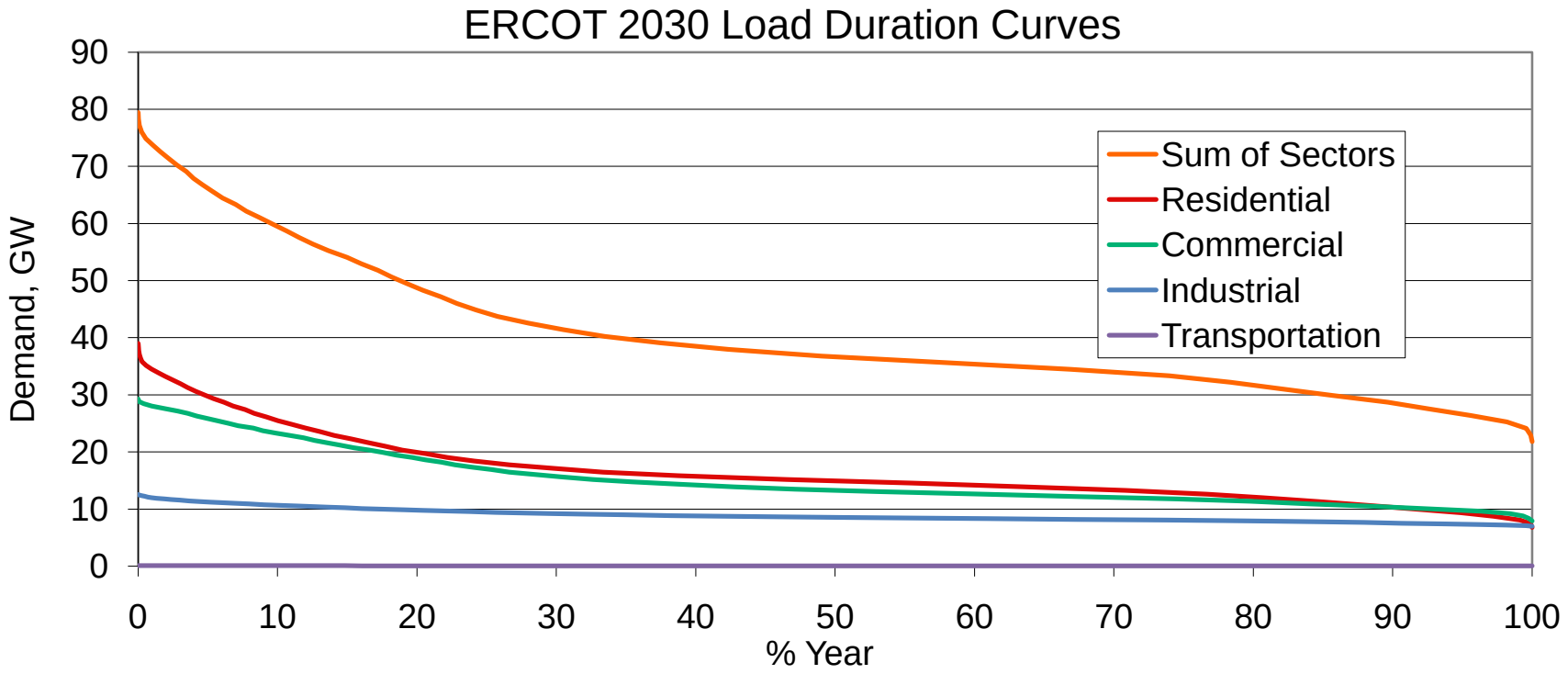
- Does not include PHEV demands





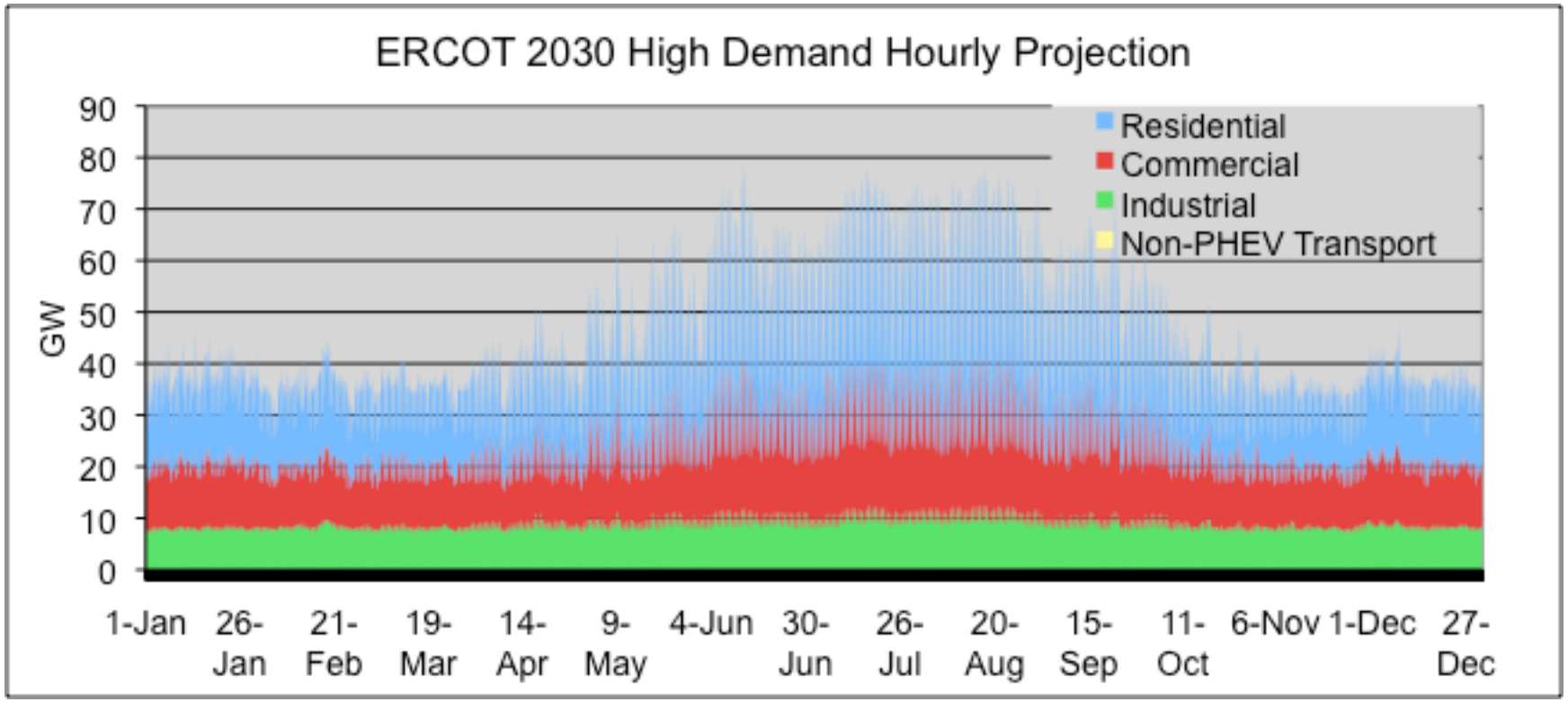
Texas Load Duration Curve Projection

- Industrial load lower and flatter than others
- Data does not include PHEV loads



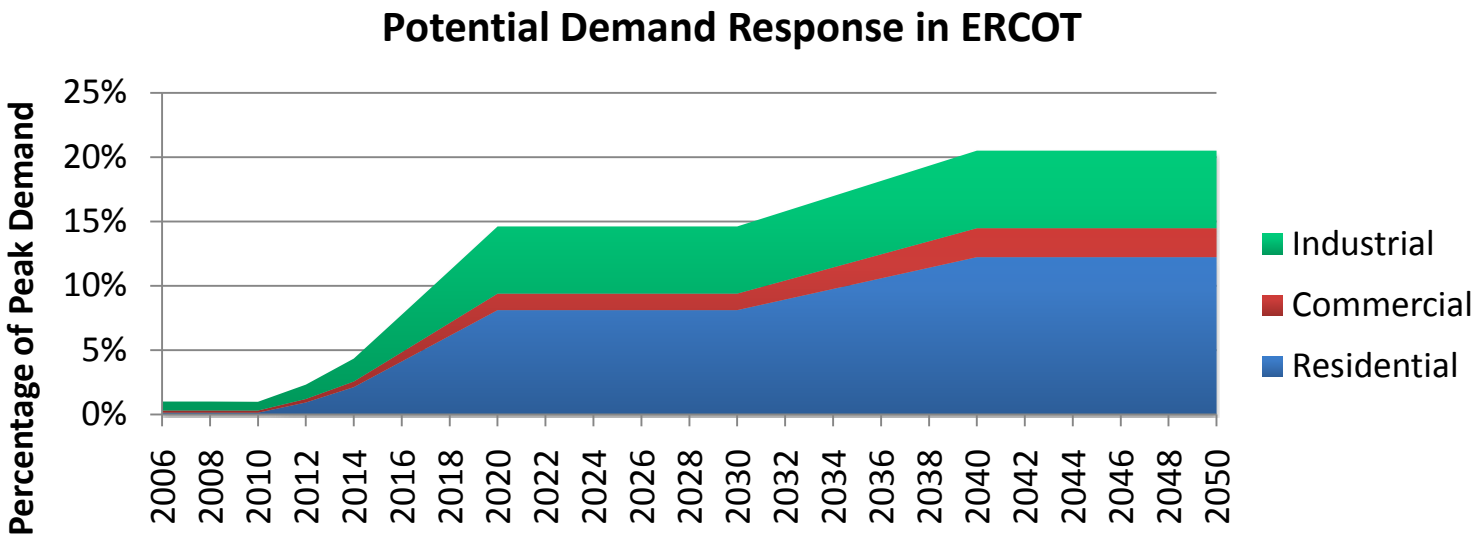
ERCOT Hourly Loads

- Applying 2006 template gives hourly variations in loads



Demand Response

- Demand Response treated as supply of system reserves
- Selected in model based on cost and availability
- Amount and cost based on FERC study
  - Percentage of peak demand for each DR and customer type
  - Vary over time from BAU to Full Participation

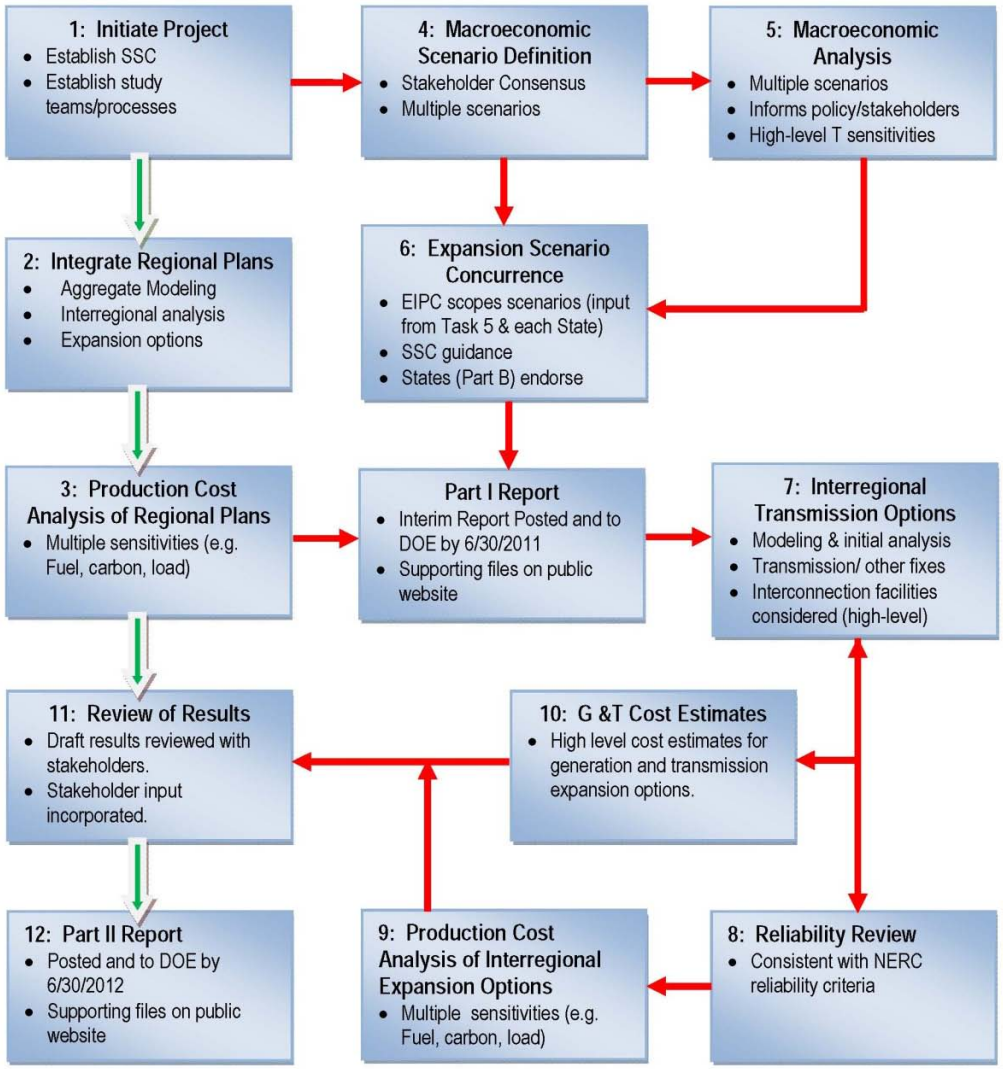


Eastern Interconnect Process

- Eastern Interconnect Planning Collaborative
  - Planning Authorities, including 8 principal investigators
  - Contractors- Charles Rivers Assoc. and Keystone Group
- Eastern Interconnect State Planning Council
  - Representatives from 39 states in Eastern Interconnect
  - Contractors for added studies
- Stakeholder Steering Committee
  - Formed by EIPC to gather guidance on scenarios and plans
  - Made up of EISPC representatives, environmental and consumer groups, industry representatives
  - Regional and sectoral representation balance

EI Flowchart

- Roll-up of existing Transmission Plans
- Macro-economic Analyses
  - SSC picks 8 Futures with ≤9 sensitivities each
- Transmission Analyses
  - 3 Transmission plans
  - Reliability review
  - G&T Cost Estimate
- Production cost model
  - Used on the 3 plans and roll-up



Other EISPC Activities

- Identification of low- and no-carbon “energy zones”
- EISPC has funding for additional studies
- Possible topics include:
  - Renewable energy potential
  - Nuclear potential
  - Coal with CCS
  - Demand Side resources
  - Distributed generation
  - Fast-start back-up generation
  - Energy storage
  - Fuel prices
  - Market Structures
  - Power purchase agreements
  - Smart grid
  - Plug-in Hybrids

DOE National Laboratory Studies

- DOE set aside $20 million from Transmission funding for National Laboratory studies
- DOE identified four areas of interest
  - Transmission Reliability
  - Demand Side Issues
  - Water and Energy
  - Other Topics
- Lead national laboratories have been identified for each
- Initial projects have been assigned
- Additional study issues may be identified by DOE and awardees

Questions?