Connecticut Department of Energy and Environmental Protection

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

2016 Connecticut Comprehensive Energy Strategy

SCOPING & PUBLIC INPUT SESSION

May 24, 2016

Connecticut Department of Energy and Environmental Protection

2016 CT Comprehensive Energy Strategy (CES)

Agenda for Public Scoping

- Background of the CES Proceeding; Objectives for Scoping
- Tentative Schedule for 2016 CES Proceeding
- Organization of the 2016 CES
- Guiding Principles for 2016 CES
- Public Scoping: Key Topics; Initial Data; Research Questions
  - Electricity Sector
  - Buildings & Processes Sector
  - Transportation Sector
- Next Steps

Background of the CES Proceeding

Statutory Authority

(C.G.S. § 16a-3d) requires DEEP to develop a CES every three years that incorporates:

- A plan for the state's energy needs
- IRP, Green Bank renewables plan, and Energy Assurance Plan
- Assessment of current energy supplies, demands, and costs
- Factors likely to affect the energy future
- Statement of progress toward achieving 2013 CES goals
- Statement of energy policies, objectives, and strategies
- Recommendations for legislative and administrative actions
- Assessment of potential cost savings/benefits to ratepayers
- Benefits, costs, obstacles, and solutions to expanding natural gas

Background of the CES Proceeding

2013 Comprehensive Energy Strategy

- Draft issued October 2012; Final CES issued February 2013
- Over 300 written comments received; 5 public hearings
- Five chapters: Energy Efficiency, Industry, Electricity, Natural Gas, and Transportation
- Broad range of recommendations
- Various pathways for implementation, including:
  - Legislation adopting CES recommendations (e.g., Public Act 13-298)
  - Energy Efficiency Board and C&LM Plan
  - PURA Docket 13-06-02 reviewed and approved Natural Gas Expansion Program

Objectives for Scoping

- Overview of Process and Schedule for the CES Proceeding
- Introduce Structure and Approach for the 2016 CES
- Describe guiding principles for the 2016 CES
- Summarize, by sector, new trends and developments
- Inform and invite public comment (oral and written)
  - Are we using the right guiding principles?
  - Are we focusing on the right topics?
  - Are there key issues that we have left out, under- or over-emphasized?
  - Are there data sets we should be aware of? Examples from other jurisdictions we should be considering?

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Tentative Schedule for 2016 CES

All dates subject to change:

- May 24, 2016 briefing for public scoping
- June 14, 2016 comments due for public scoping
- Early fall draft 2016 CES released
- Fall 2016 technical meetings and public hearings on draft 2016 CES
- December 2016 comments due for incorporation into 2016 CES
- January 2017 release of 2016 CES

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Organization of the 2016 CES

The 2016 CES covers the same topics as the 2013 CES but recognizes buildings as critical elements of an integrated energy infrastructure.

2013 CES Chapters	2016 CES Sectors
Electricity	Electricity
Energy Efficiency	Buildings and Processes
Industry	
Natural Gas	
Transportation	Transportation

Governor's Council on Climate Change (GC3)

GC3 Analysis Tasks and Timeline

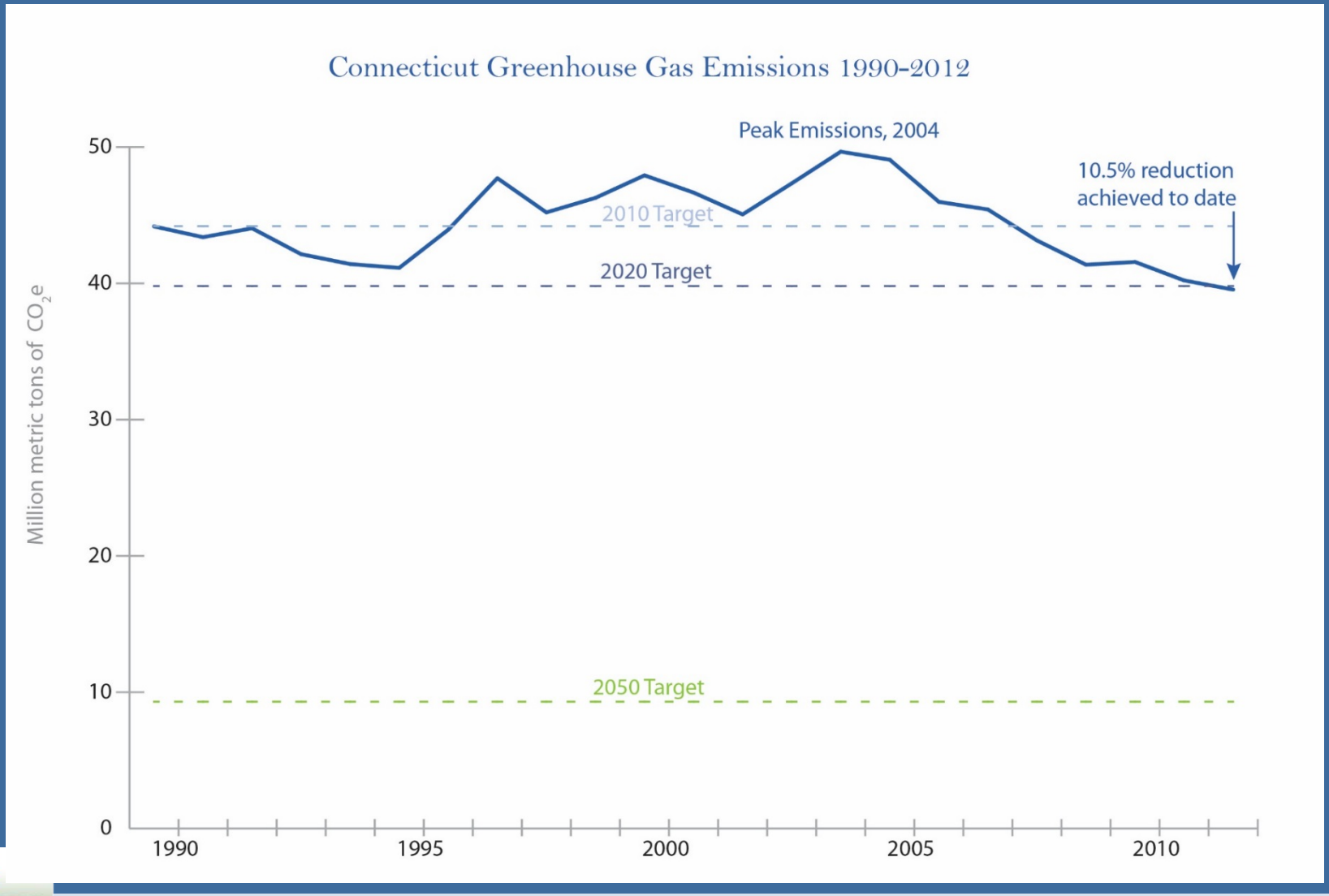
2016 Tasks	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.
Task 2 Build technologies and measures into the Long range Energy Alternatives Planning System (LEAP – chosen modeling tool).											
Task 3 Develop GHG mitigation scenarios and policy narratives.											
Task 4: Develop a menu of policy recommendations.											

GC3: Analyzing technologies and measures that will have the largest GHG reduction potential and developing scenarios for modeling emissions into the future.

By investigating a variety of potential GHG mitigation scenarios, the GC3 will recommend an interim GHG reduction target (35%-55% below 2001 levels by 2030) and identify potential strategies that can achieve the recommended midterm target & the 80% below 2001 levels by 2050 GWSA target.

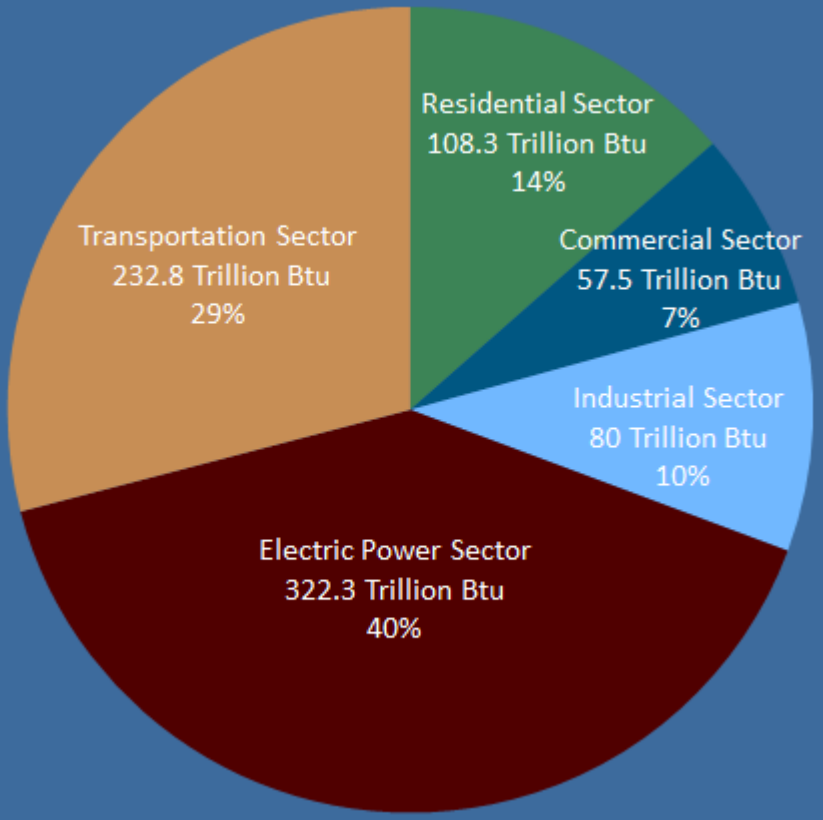
CES: More detailed focus on design of policies and mechanisms necessary to implement possible strategies identified through the GC3 process. Assessment of costs and benefits, impacts on rates, reliability, sustainability, etc. of recommended strategies.

Organization of the 2016 CES

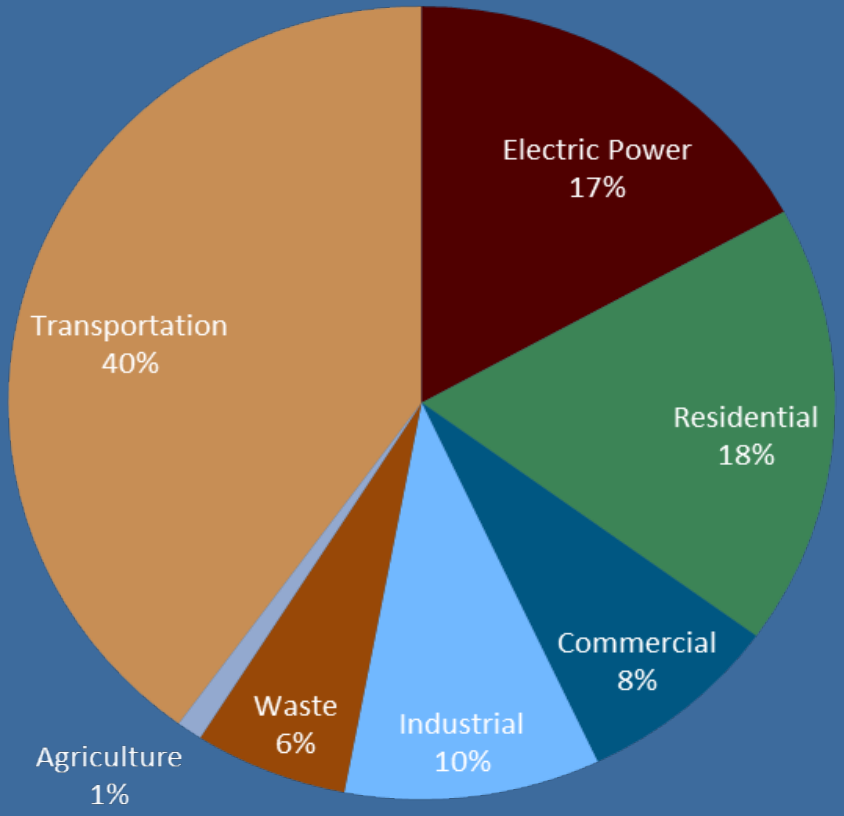


Organization of the 2016 CES

CT Energy Consumption by Sector, 2012



CT GHG Emissions by Sector, 2012



Sources: U.S. Energy Information Administration State Energy Data System (2013 data); and EPA SIT tool (2012 data)

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Guiding Principles for 2016 CES

Cheaper, Cleaner, More Reliable and Sustainable… for Communities and Customers

- Lower bills
- Reduced volatility
- Equitable rates
- Equal opportunity for energy savings
- Lower fuel costs, relative to other types of fuels
- Scaling clean energy resources at lowest cost to ratepayers through optimal use of grants and financing
- Connecticut's 2015 Economic Development Strategy

Guiding Principles for 2016 CES

Cheaper, Cleaner, More Reliable and Sustainable… for Communities and Customers

- Climate: 2008 Global Warming Solutions Act
  - ✓ Reduce greenhouse gas emissions by 10% below 1990 levels by 2020
  - → Reduce greenhouse gas emissions by 80% from 2001 levels by 2050
- Air quality
  - → Achieve attainment for 8 hour ozone National Ambient Air Quality Standards
  - → Reduce regional haze, NOX, SOX, & fine particulates
- RPS objectives: 20% Class I renewables by 2020
- Comprehensive Materials Management Plan
  - → Increase statewide diversion rate to 60% by 2024
  - → Recover energy from materials

Guiding Principles for 2016 CES

Cheaper, Cleaner, More Reliable and Sustainable… for Communities and Customers

- Address increased reliance on natural gas generation, gas pipeline constraints
- Integration of intermittent and distributed clean energy resources
- Evolving threats to grid security: cyberattacks, climate change
- Security of delivered fuels for building heating
- Transportation infrastructure challenges: congestion, aging infrastructure

Guiding Principles for 2016 CES

Cheaper, Cleaner, More Reliable and Sustainable… for Communities and Customers

- Siting of energy infrastructure
- Vegetation management
- Cooling water/ water management
- Responsible growth
- Federal, Regional and Municipal Plans
- State Plan for Conservation and Development
- Connecticut's Comprehensive Open Space Acquisition Strategy - The Green Plan
- Water Quality Plan

Guiding Principles for 2016 CES

Cheaper, Cleaner, More Reliable and Sustainable… for Communities and Customers

- Tailored energy solutions for all residents and businesses, through increased efficiency of key sectors such as low income communities, multi-family residential properties, manufacturing, commercial office buildings, and government facilities
- Grid modernization enabling on-site generation and two-way distribution and capturing locational benefits
- Achieving lower costs through customer aggregation
- Customer education and empowerment
- Role for municipalities
- Quality of life/ mobility oriented development

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Electricity Sector

Regulation of Electric Industry

Regulation

- Integrated utilities: generation, distribution, transmission
- Cost of service regulation
- All regulated by PURA

Deregulation

- Generation owned by private companies
- Generation not regulated but operates & earns revenues in ISO-NE/FERC markets
- Retail suppliers sell power to costumers
- Distribution & transmission owned by Local Distribution Companies
- Planning & operation of transmission by ISO-NE/FERC- COS regulation
- Distribution regulated by PURA-COS regulation

Global Warming Solutions Act

Global Warming Solutions Act, Conn. Gen. Stat. §§ 22a-200 to 200b:

- 2020 Goal: Calls for a 10% reduction in GHG emissions between 1990-2020 (relative to 1990 levels)
- 2050 Goal: Mandates the long-term goal of an 80% reduction by 2050 (relative to 2001 levels)

✓ From 1990 to 2012 Connecticut reduced its emissions by 10.5%, thereby reaching its 10% reduction by 2020 target under the Global Warming Solutions Act and now aims to continue this progress and achieve greater reductions

State RPS Policy Requirements

Year	Class I	Class II	Class III	Total
2010	7.0%	3.0%	4.0%	14.0%
2011	8.0%	3.0%	4.0%	15.0%
2012	9.0%	3.0%	4.0%	16.0%
2013	10.0%	3.0%	4.0%	17.0%
2014	11.0%	3.0%	4.0%	18.0%
2015	12.5%	3.0%	4.0%	19.5%
2016	14.0%	3.0%	4.0%	21.0%
2017	15.5%	3.0%	4.0%	22.5%
2018	17.0%	3.0%	4.0%	24.0%
2019	19.5%	3.0%	4.0%	26.5%
2020	20.0%	3.0%	4.0%	27.0%

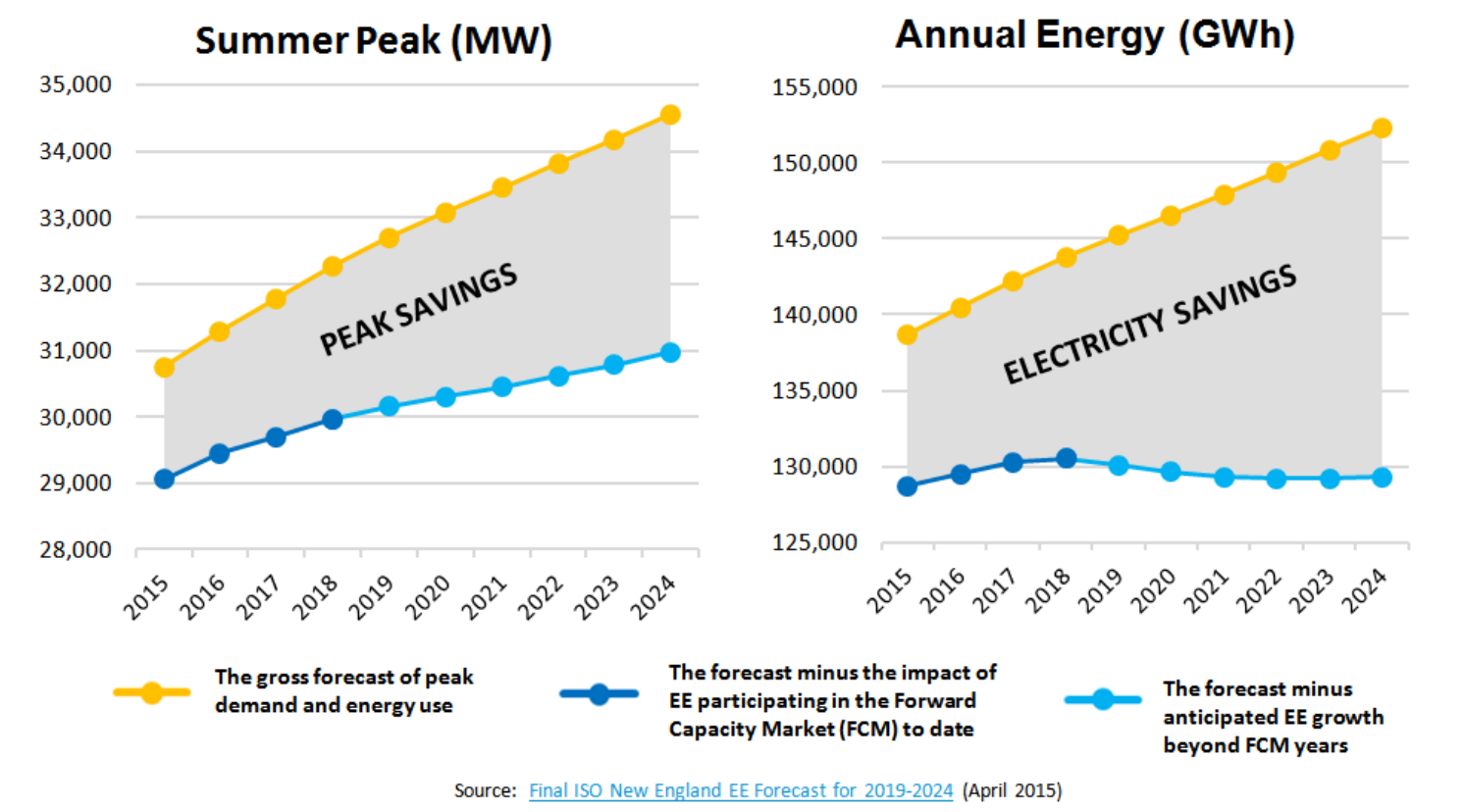
"Class I renewable energy source" is electricity derived from: solar or wind power, fuel cell, geothermal, landfill methane gas, anaerobic digestion or biogas derived from bio sources, thermal electric direct energy conversion, wave/tidal power, low emission renewable energy conversion technologies, run-of-the-river hydro, or biomass facility that meets the requirements

"Class II renewable energy source" is energy derived from: trash-to-energy or biomass facility provided that it meets emissions requirements, or a run-of-the-river hydropower

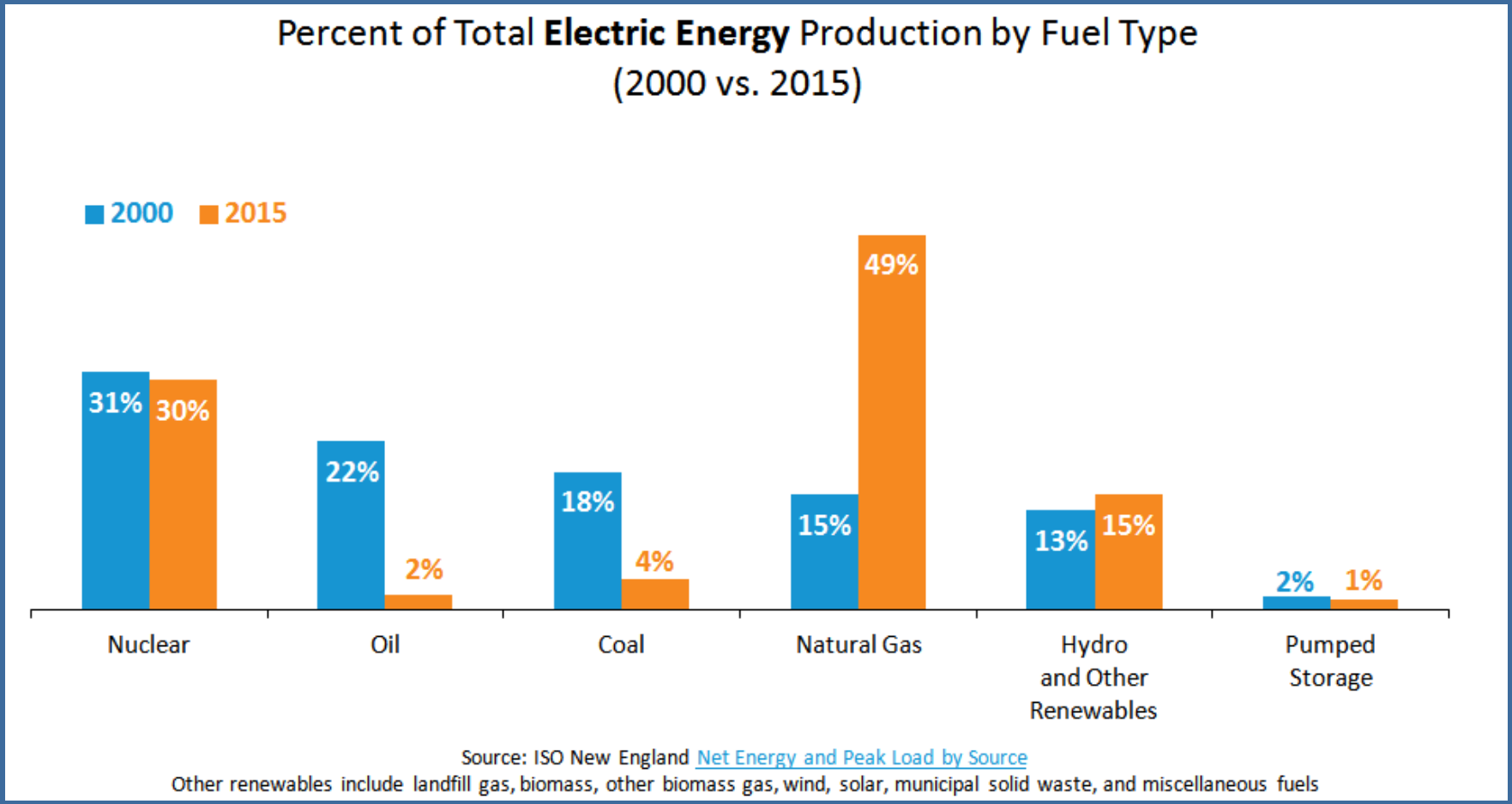
"Class III energy source" is the electricity output from: combined heat and power systems that meet the required operating efficiency level and other requirements and electric conservation not funded by electric ratepayers.

Energy Demand

- Slow growth in peak demand
- Flat demand in electric energy consumption



Regional Fuel Mix



Power Plant Emissions Have Declined

Reduction in Aggregate Emissions (ktons/yr)

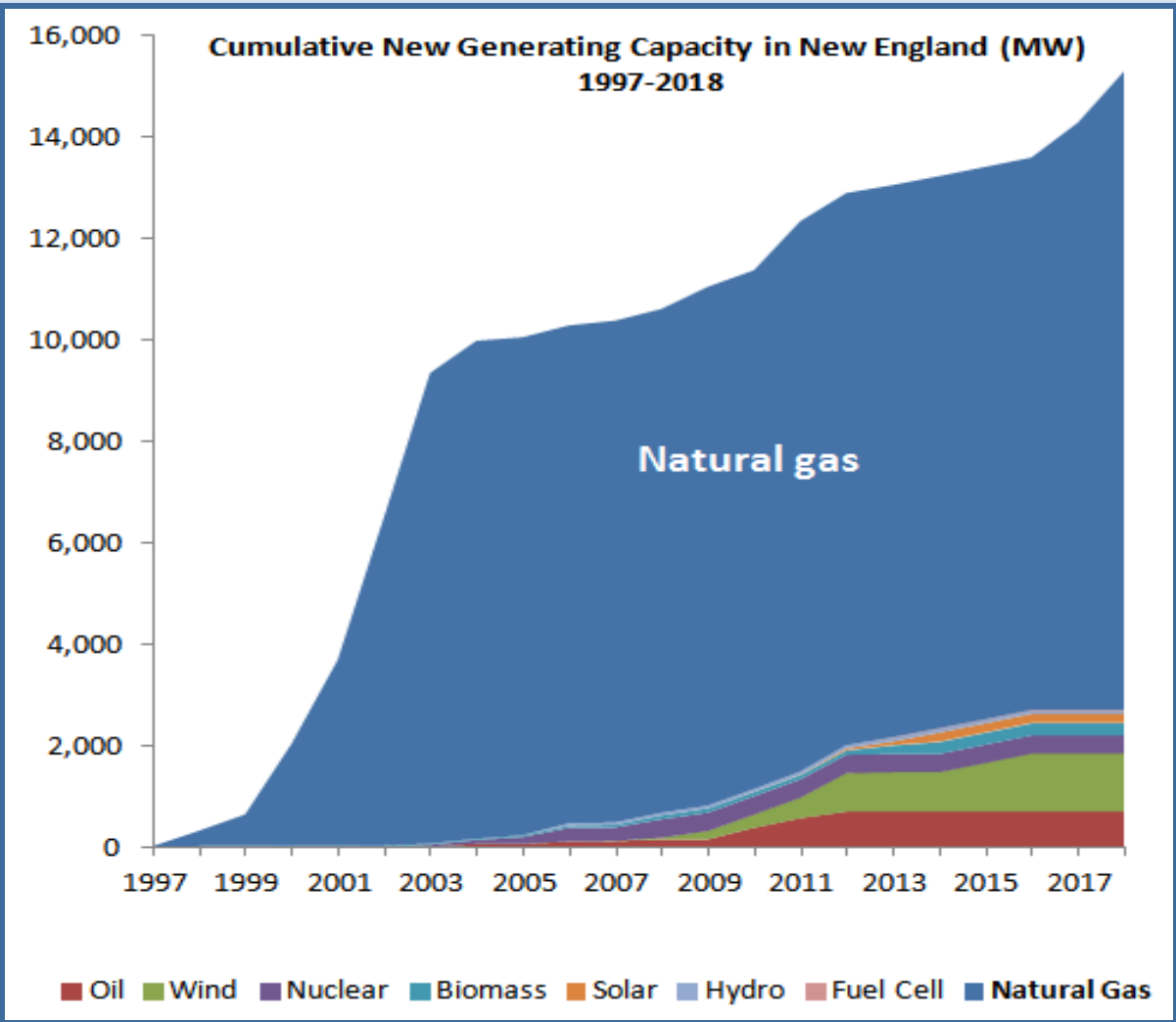
Year	NO_x	SO_2	CO_2
2001	59.73	200.01	52,991
2014	20.49	11.68	39,317
% Reduction, 2001–2014	**⬇ 66%**	**⬇ 94%**	**⬇ 26%**

Reduction in Average Emission Rates (lb/MWh)

Year	NO_x	SO_2	CO_2
1999	1.36	4.52	1,009
2014	0.38	0.22	726
% Reduction, 1999–2014	**⬇ 72%**	**⬇ 95%**	**⬇ 28%**

Source: 2014 ISO New England Electric Generator Air Emissions Report, January 2016

Transformation of Region's Resource Mix



Graphic taken from ISO New England's January 26, 2016 *"State of the Grid"* presentation

Generator Retirements

Major Generator Retirements:

Salem Harbor Station (749 MW)

– 4 units (coal & oil)

Vermont Yankee Station (604 MW)

– 1 unit (nuclear)

Norwalk Harbor Station (342 MW)

– 3 units (oil)

Brayton Point Station (1,535 MW)

– 4 units (coal & oil)

Mount Tom Station (143 MW)

– 1 unit (coal)

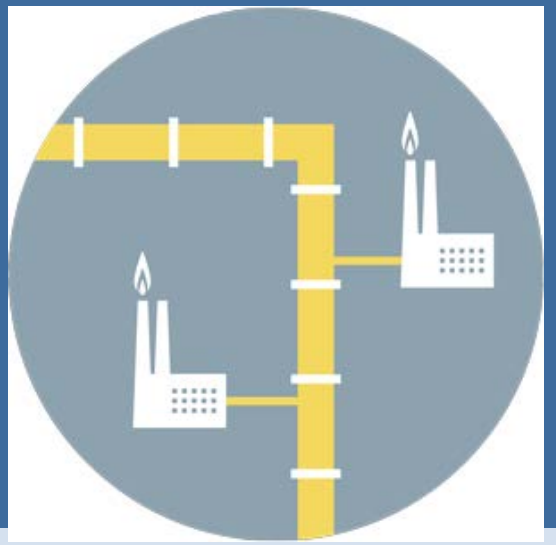
Pilgrim Nuclear Power Station (677 MW)

1 unit (nuclear)

Additional retirements are looming

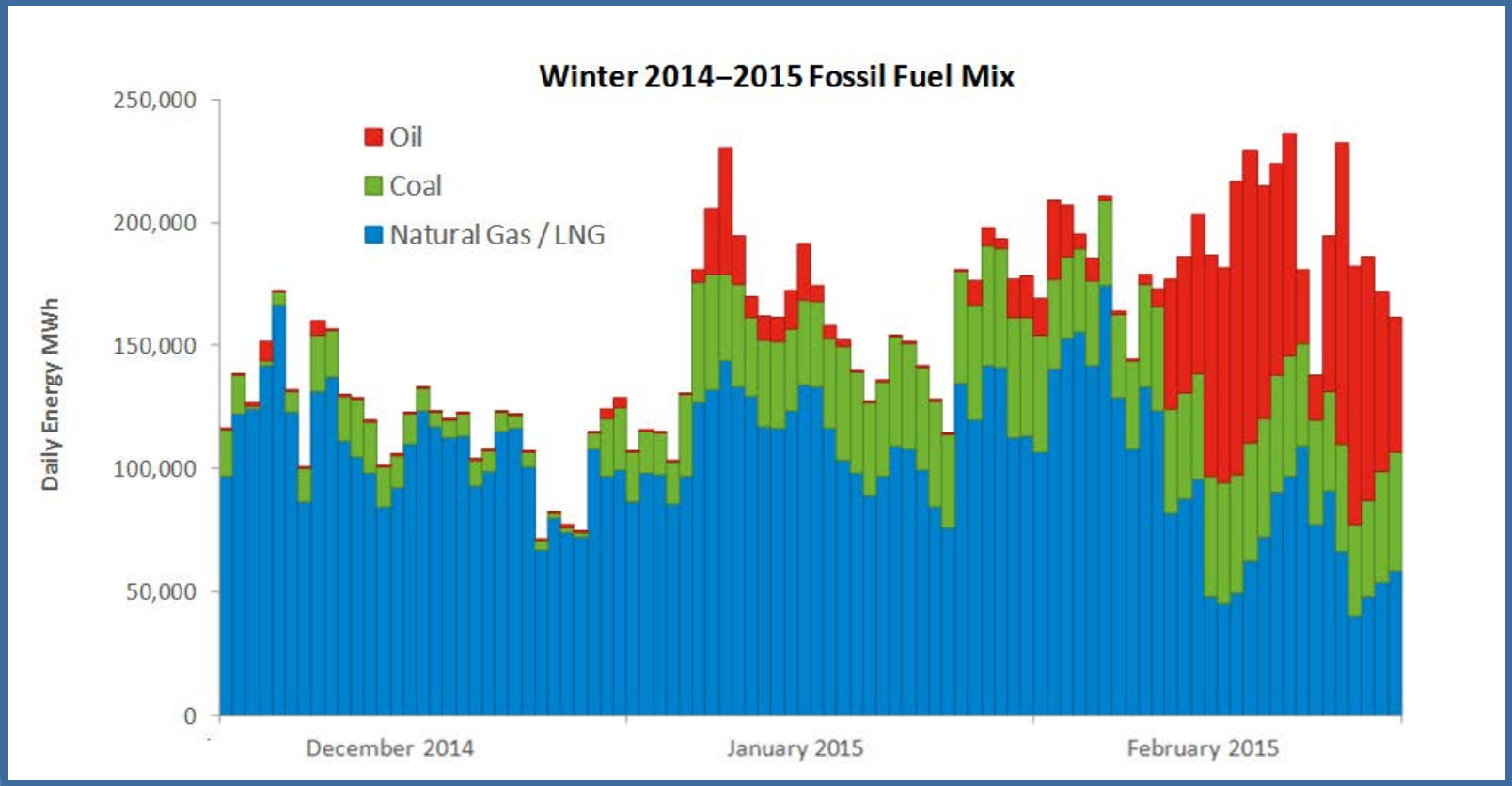
Winter Operations Highlight Natural Gas Pipelines Constraints as a Continuing Reliability Challenge

- Close to half—**13,650 MW, or 44%**—of the total generating capacity in New England uses natural gas as its primary fuel
- 2015/16 winter outlook identifies up to **4,220 MW** of natural gas-fired generation at risk of not being able to get fuel when needed
- To address continuing concerns about natural gas pipeline constraints, the ISO will administer **Winter Reliability Programs** until 2018 to help improve fuel security and protect power system reliability



Winter Fuel Mix

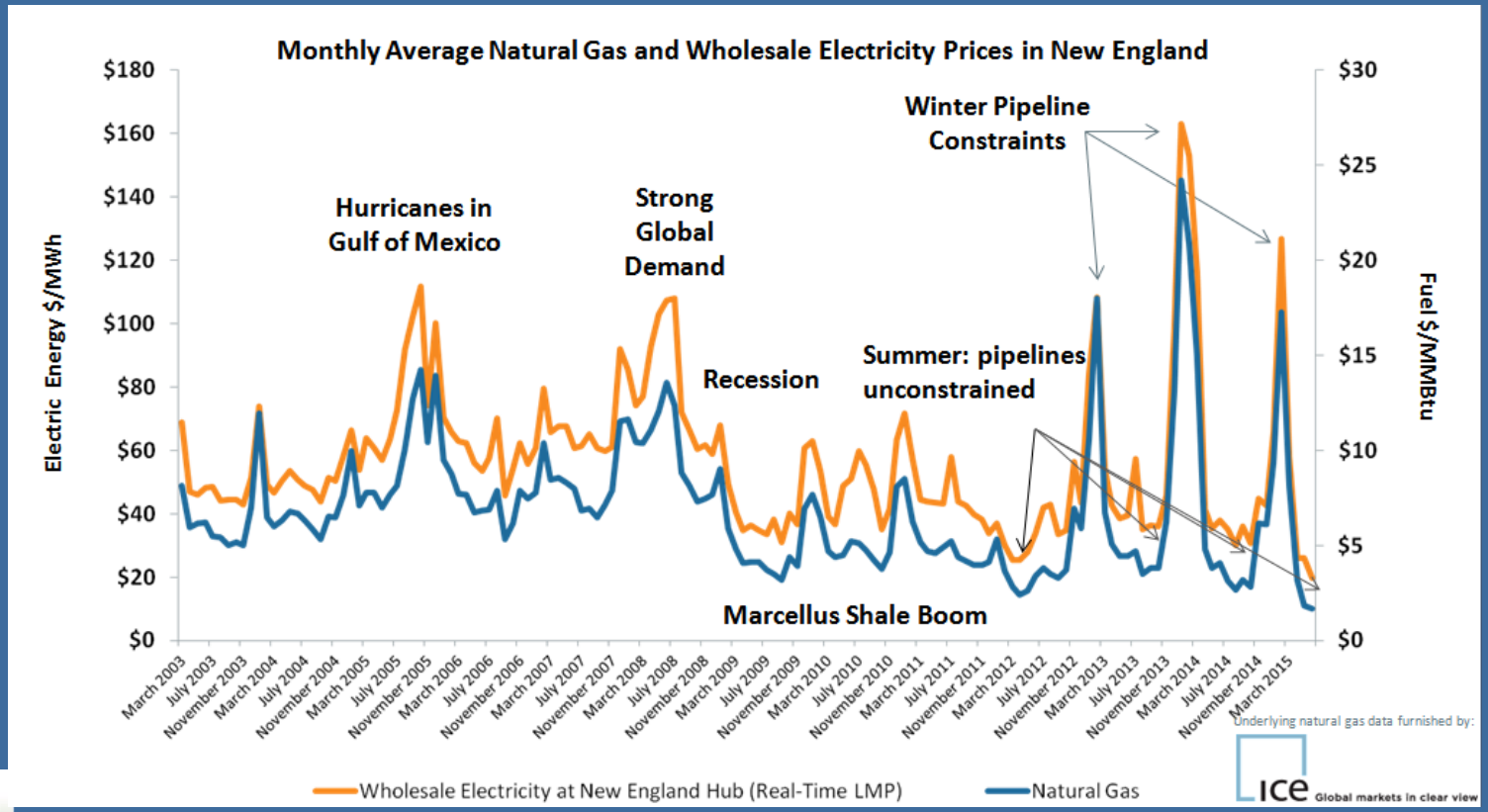
- Gas unavailable during winter months due to pipeline constraints
- This threatens system reliability, increases electric costs, and requires more oil and coal generation



Graphic taken from ISO New England's January 26, 2016 *"State of the Grid"* presentation

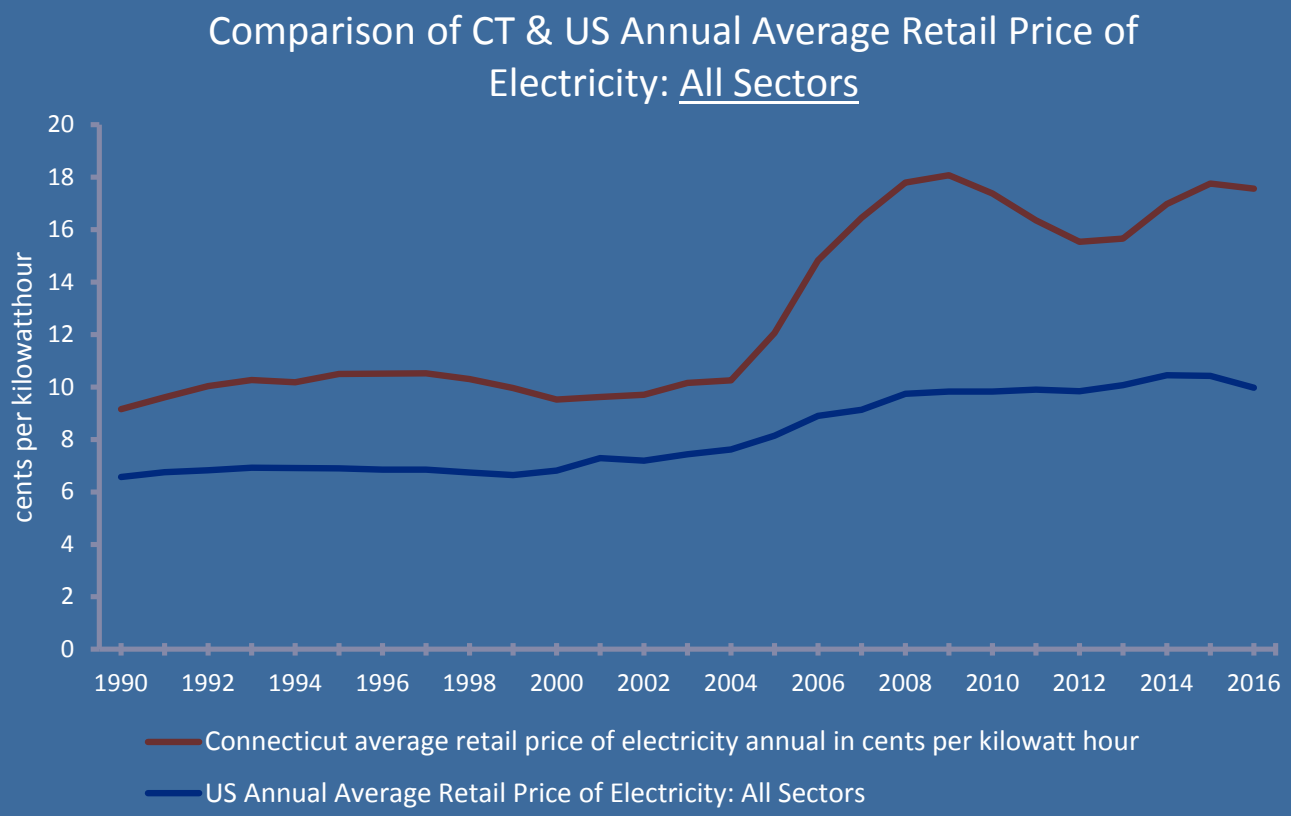
Electric Generation Rates Linked to Natural Gas

- High winter prices during winter months when gas pipelines are constrained
- Since March 2015, electric prices are declining overall



State of the Electricity Sector - Rates

- Connecticut's electric rates are consistently well above the national average but aggressive energy efficiency helps lower bills



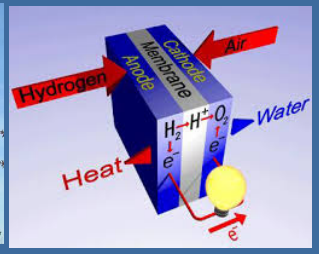
Existing Renewable Generation Programs

- In-state solar programs (authorized up to 330 MW)
  - Connecticut's Green Bank Residential Solar (RSIP): 18,000 solar homes and growing

- LREC/ZREC
  - Low Emissions and Zero Emissions Renewable Energy Credit Program to buy down cost of RECs through a reverse auction process.
  - Estimated 2,000 projects
  - 500 MW total from the 5 year program







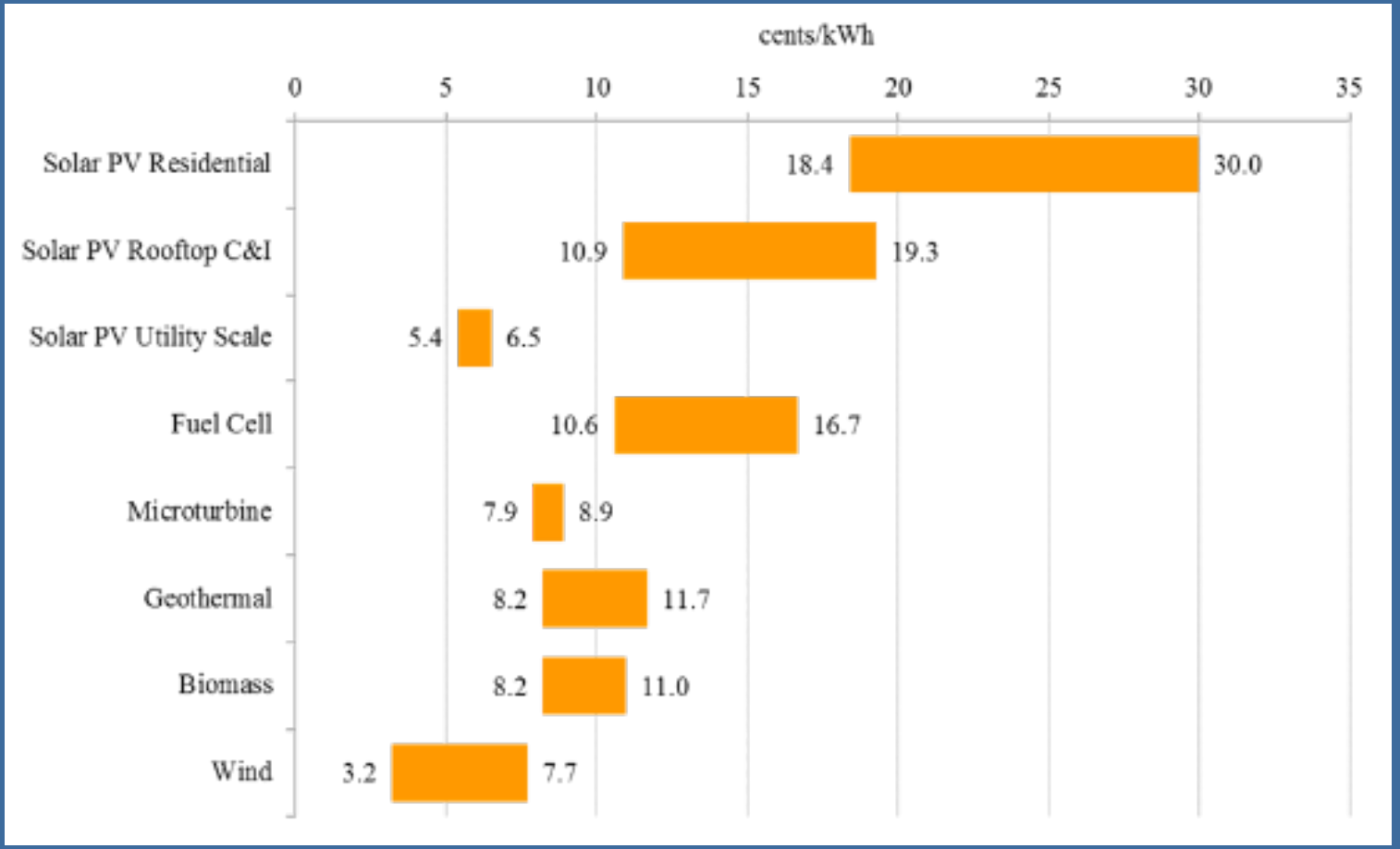
Existing Renewable Generation Programs

- Utility-Scale Competitive Clean Energy Procurements:
  - DEEP authorized to require the electric distribution companies (EDCs) to enter into long-term power purchase contracts in the procurement of renewable energy generation through a competitive bidding process.
  - Section 127 = 30 MW of solar, wind, and fuel cells constructed
  - P.A. 13-303 Section 6 = contracts for 270 MW of wind and solar
  - P.A. 13-303 Section 8 = contracts for biomass RECs

Existing Renewable Generation Programs

- Utility-Scale Competitive Clean Energy Procurements continued:
  - P.A. 13-303 Section 7 = procurement of projects over 20 MW for Class I renewables and/or large-scale hydro for up to 5% of electric load is being conducted as part of Section 15-107c procurement
  - P.A. 15-107 Sections 1b & 1c = DEEP may require the EDCs to enter into long-term PPAs for up to 10% of electric load
    - B: Procurement for projects under 20 MW currently under way. Includes Class I and Class III, conservation, and storage
    - C: Procurement for projects over 20 MW currently under way. Coordinated with Massachusetts and Rhode Island utilities. Includes Class I renewables and large hydro
  - Shared Clean Energy Facilities pilot program = draft RFP for projects up to 6 MW; investigate cost and benefit of clean energy facilities

Cost of Renewable Generation



Source: data extracted from the 2015 Lazard Levelized Cost of Energy Analysis – Version 9.0.

Existing Programs to Ensure Reliability

- PURA proceedings on grid resiliency and cybersecurity
- Electric conservation program
- Microgrid program
- Grid modernization pilot program to investigate technologies to integrate DG
- Gas Infrastructure Procurement (Section 15-107) to improve winter reliability. RFP to be issued soon

Potential Opportunities

1. Reduce Peak Demand
2. Increase and Retain Low- or No-Carbon Resources
3. Improve Reliability
4. Modernize the Grid and Integrate Distributed Energy Resources
5. Limit Rate Increases and Provide Opportunities for Customers to Reduce Electric Bills

2016 CES Scoping: Scaling New Clean Energy

1. *What policies and mechanisms are need to scale deployment of <u>new</u> clean energy resources?*
   a. How much incremental clean energy is needed to stay on track to meet Connecticut's 2050 GWSA carbon reduction target? What types of clean energy resources should be relied upon or prioritized to meet the GWSA target (e.g., low- or zero-carbon renewables; conservation; demand response; large-scale hydropower; combined heat and power; etc.)?

   b. How well are existing programs achieving incremental clean energy deployment? What are the relative costs and benefits (to participants, ratepayers, and society) of these existing programs? What are the barriers to equitable participation for these different programs?

   c. …see next slide

2016 CES Scoping: Scaling New Clean Energy, Cont'd

1. *What policies and mechanisms are need to scale deployment of new clean energy resources (continued)?*
   c. What new policies and mechanisms are needed to scale deployment of new clean energy resources, minimizing costs and rate impacts while maximizing participant, ratepayer, and societal benefits? Topics include:

      i. Reliable integration of clean energy into the transmission and/or distribution system, including investments in interconnection and balancing of intermittent resources?
      ii. Should policy mechanisms prioritize (ie., potentially allow for cost premium for) in-state vs. regional deployment; equitable participation among customers; societal and economic development benefits?
      iii. What policy mechanisms should the state enact to encourage sustainable siting of clean energy?

2016 CES Scoping: Deregulated Markets and Connecticut Public Policy

2. *What are the challenges and opportunities for achieving Connecticut's state public policy goals in a deregulated electricity market?*
   a. Are new policies and mechanisms needed to retain existing clean energy resources (e.g., existing nuclear, waste-to-energy, combined heat & power, and others) to stay on track to meet Connecticut's 2050 GWSA carbon reduction target, and/or other state public policy goals (e.g. Comprehensive Materials Management Plan)?
   b. If yes, what are the best policies and mechanisms to retain existing resources while minimizing risk and cost to electric ratepayers?
   c. What are the barriers and opportunities for achieving new clean energy resource deployment in a deregulated electricity market? What policies should Connecticut consider to address those barriers and opportunities?

2016 CES Scoping: Securing Cheaper Electricity Options

3. *What strategies should be put in place to reduce electric costs for Connecticut families and businesses?*
    a. How well is the competitive supplier market performing in providing lower cost and/or more diverse electricity options for Connecticut customers?

    b. What strategies should be put in place to provide opportunities for customers to control their consumption, e.g. through conservation, demand resource, rate design (volumetric vs. fixed charges), time of use rates?

2016 CES Scoping: Ensuring Reliability

4. *What strategies are needed to ensure electric reliability?*

   a. What are the major threats to the reliability of electric service at the transmission and distribution level? How have these threats evolved since the 2013 CES and 2014 Integrated Resource Plan?

   b. Examples may include:
      i. Cybersecurity
      ii. Climate change threats to both distribution and transmission systems
      iii. Inadequate gas pipeline capacity during winter peak demand
      iv. Maintaining diversity of fuel sources for generation
      v. Reliable integration of intermittent and distributed clean generation

   c. How well are existing policies and mechanisms addressing these threats, and what additional policies and mechanisms should be considered to address these threats in the future? Should the state prioritize distributed solutions to address reliability challenges?

2016 CES Scoping: Modernizing the Grid

5. *What policies and regulatory changes are needed to modernize the electric grid and integrate distributed energy resources (DER)?*
   a. What are the major drivers of distribution system investment over the CES planning horizon, and in what ways can those investments be effectively aligned with DER deployment? What changes should be made to improve the transparency and efficiency of distribution system planning and investment, to maximize the benefits and minimize the costs associated with integration of DERs?
   b. What polices and mechanisms should be put in place to encourage optimal DER deployment (from a society, system, and participant perspective), such as through "bundled" deployment of different types of DERs, valuation of locational benefits, time of use rates, etc.?
   c. What are the potential costs and benefits of energy storage and how can it best be deployed on the grid to maximize system and/or customer benefits?

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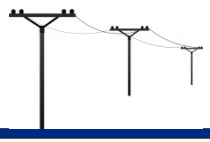
Buildings & Processes Sector

Connecticut Department of Energy and Environmental Protection

Buildings and Processes



Current State

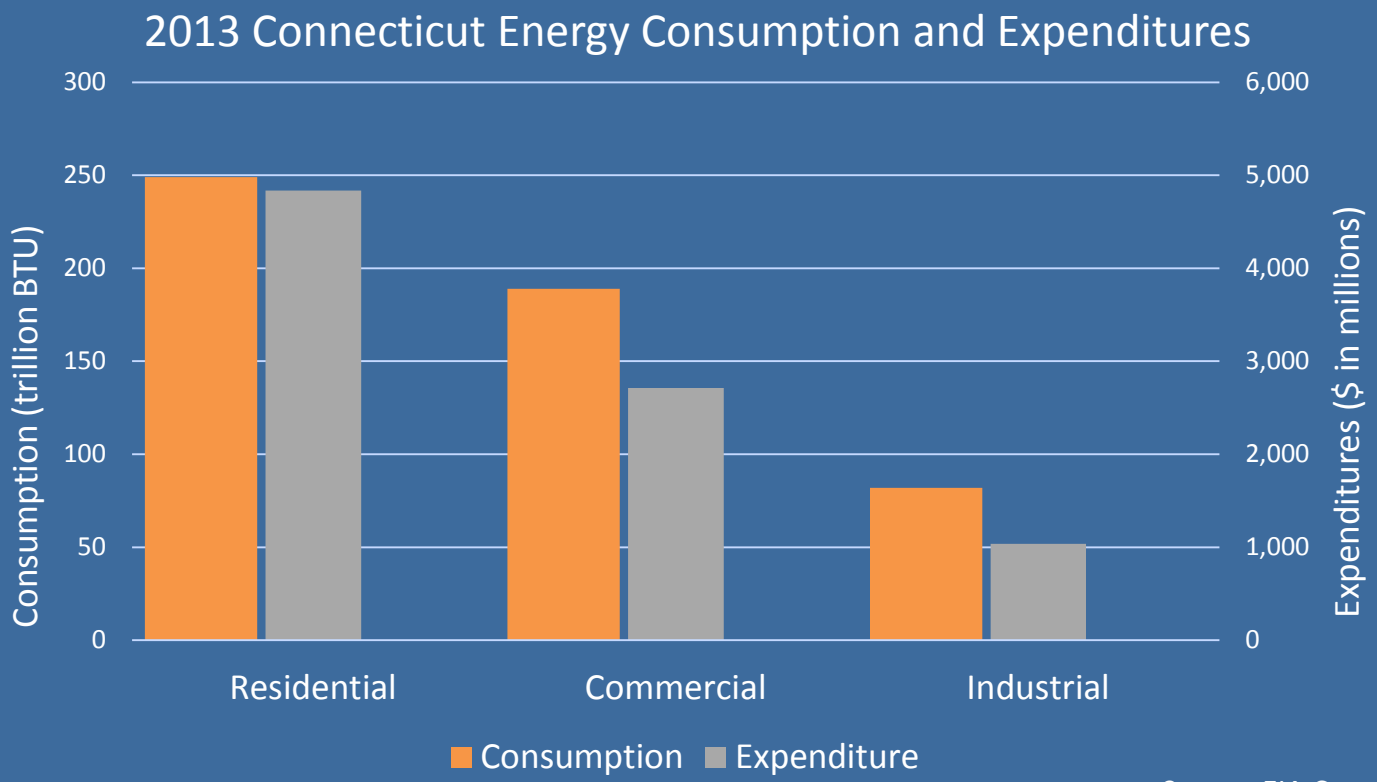
Energy Efficiency as an Energy Resource

Barriers to Scaling Implementation

Opportunities to Overcome Barriers and Increase Scale

CES 2016 Scoping Questions

Energy Use in the Buildings and Processes Sector

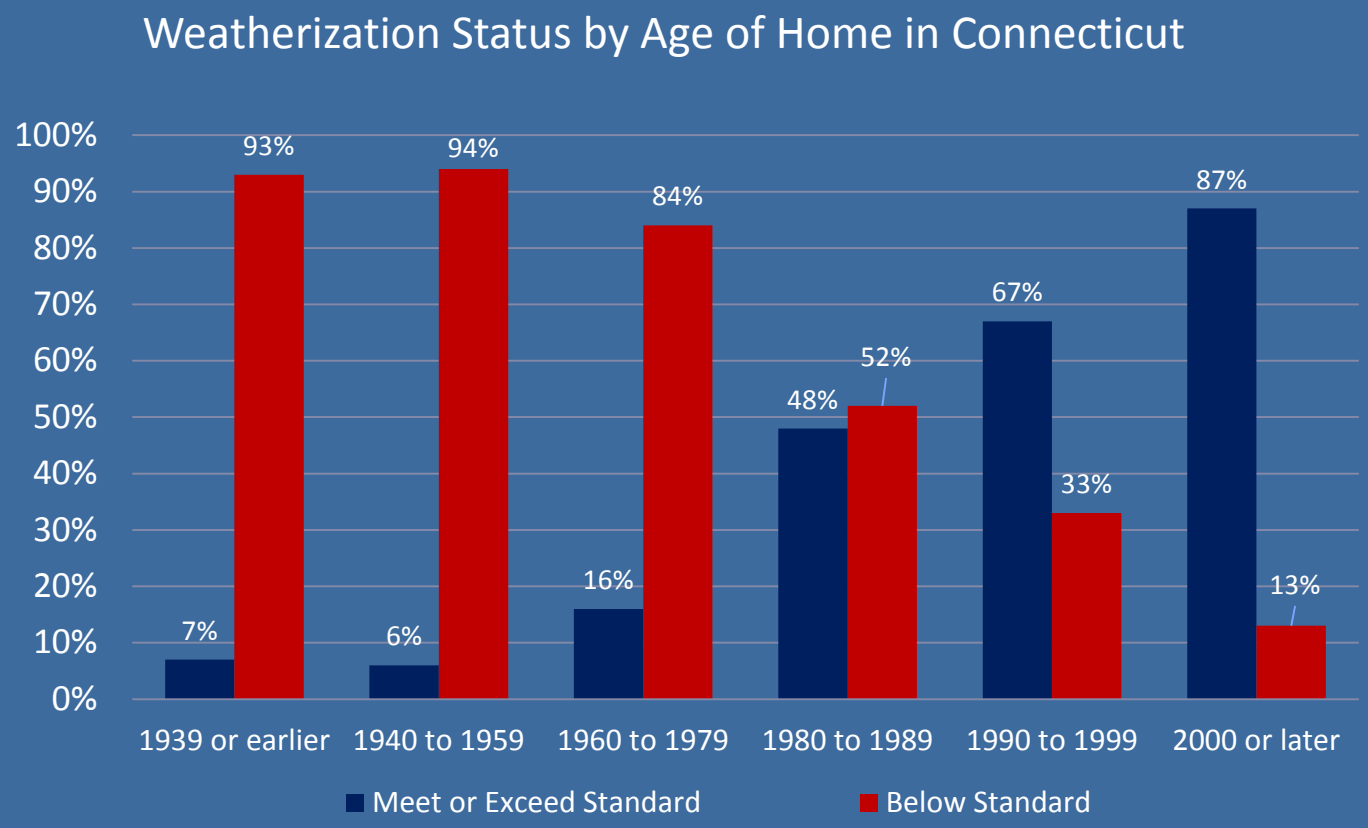


Source: EIA Connecticut Data 2013

Three classes of end users: residential, commercial, and industrial with three different energy uses: electric, thermal, processing.

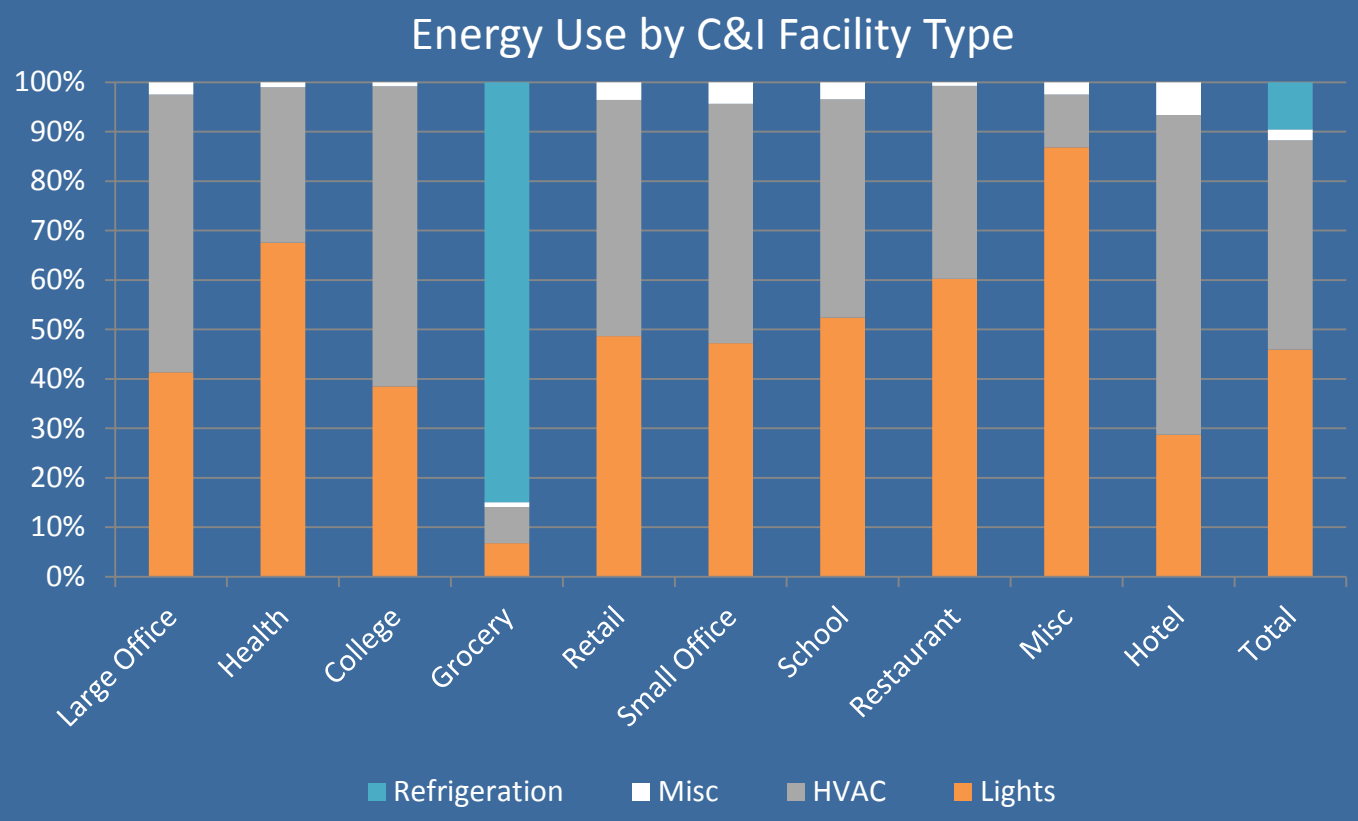
Buildings: Key Component of the Energy System

Building features shape the opportunities for CT residents to make the energy they use cheaper, cleaner, more reliable, and more sustainable.



Source: Single-Family Weatherization Baseline Assessment (R5) for the CT Energy Efficiency Fund (data from 2013)

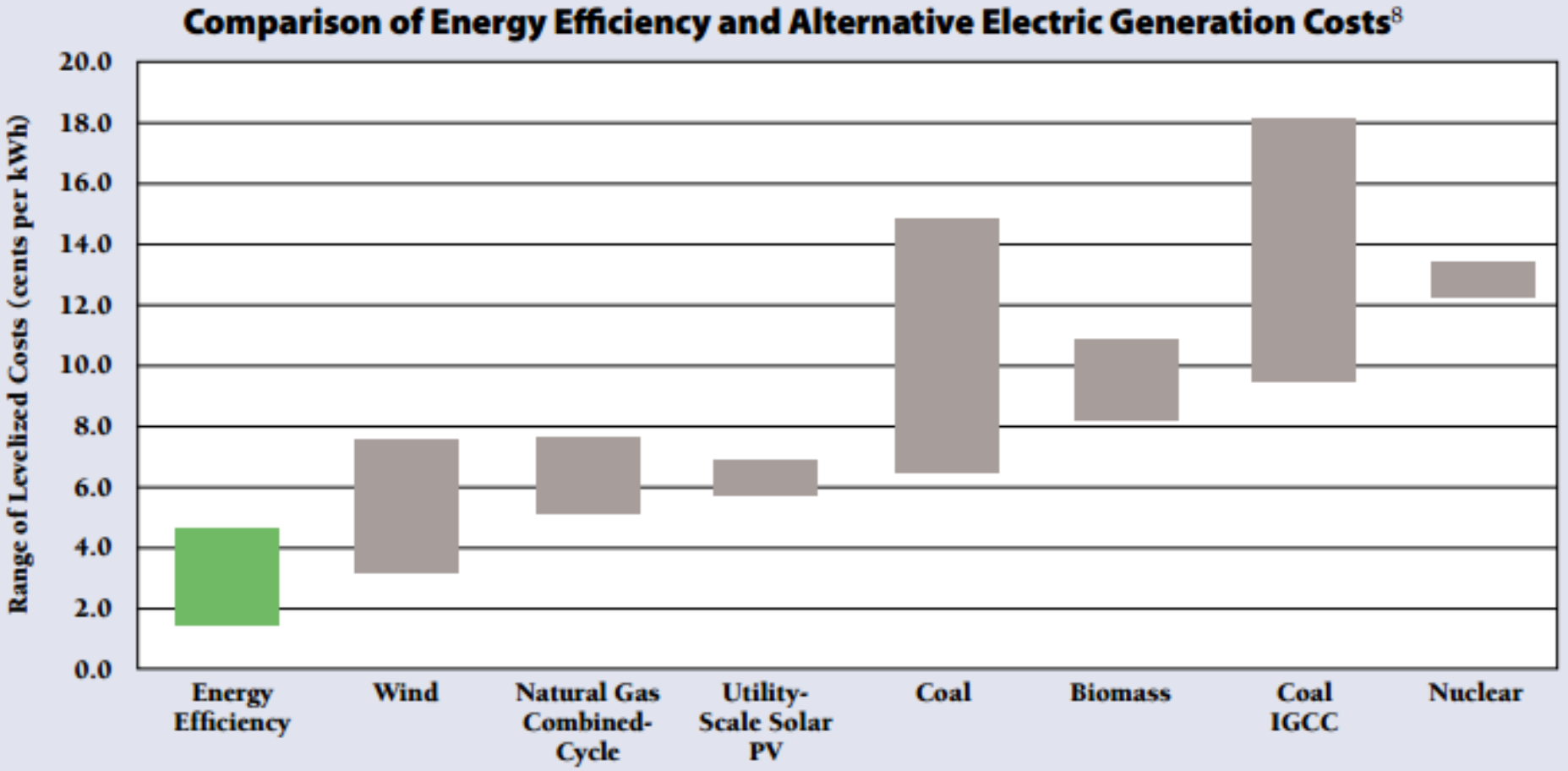
Buildings: Key Component of the Energy System



Source: Eversource 2015

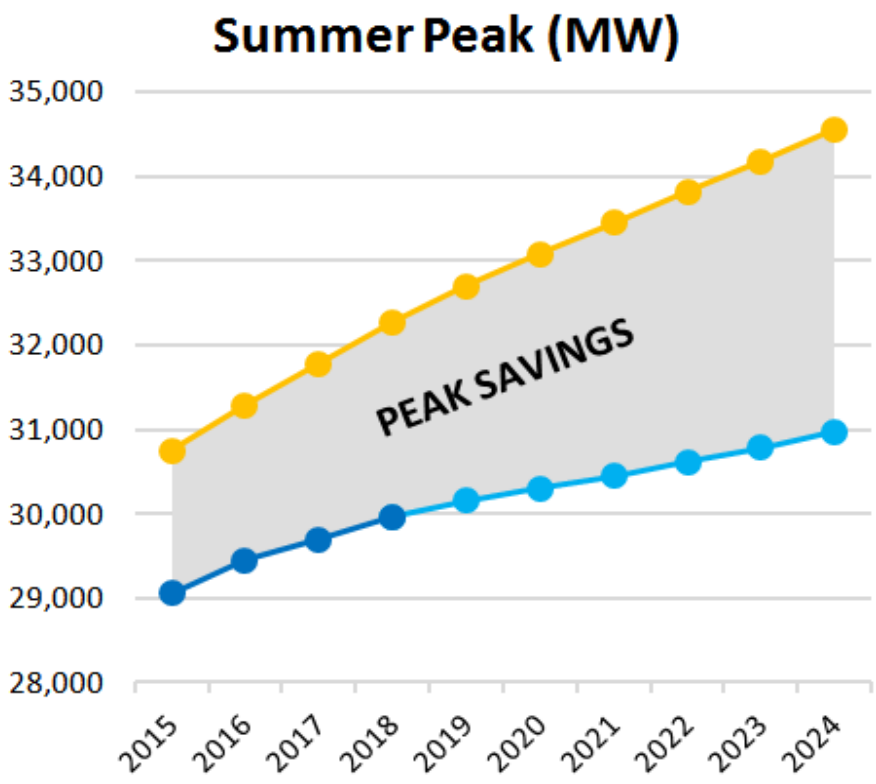
Building features shape the opportunities for CT businesses to make the energy they use cheaper, cleaner, more reliable, and sustainable.

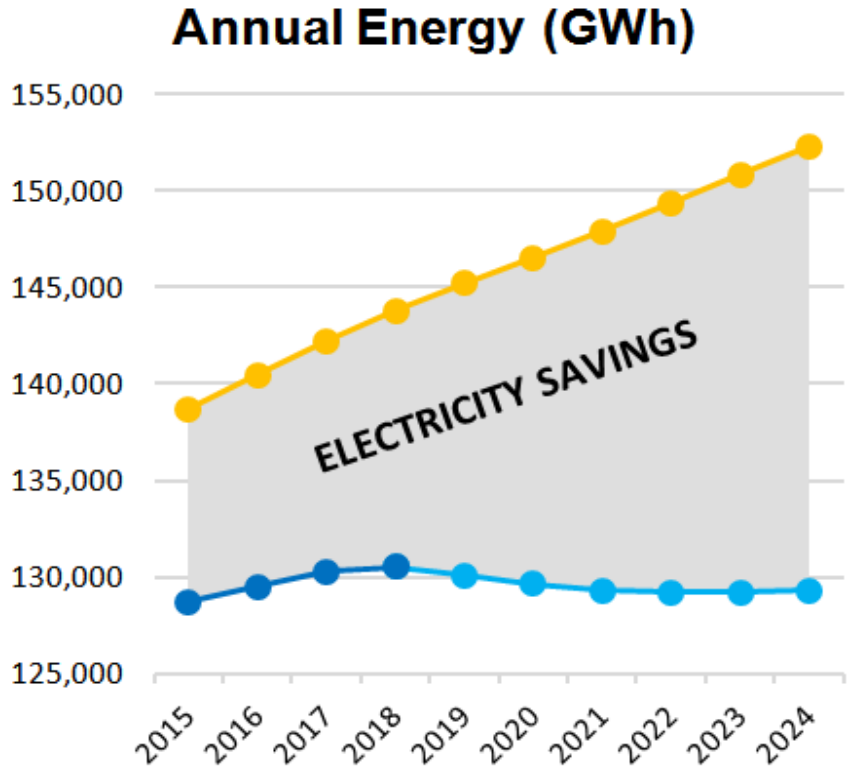
Energy Efficiency – the Cheapest Energy Option



Source: Neme, C., & Grevatt, J. (2016, February). *The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years.* The Regulatory Assistance Project: Montpelier, VT. Available at: http://www.raponline.org/document/download/id/7944.

Energy Efficiency is Slowing Peak Demand Growth and Flattening Energy Use





The gross forecast of peak demand and energy use

The forecast minus the impact of EE participating in the Forward Capacity Market (FCM) to date

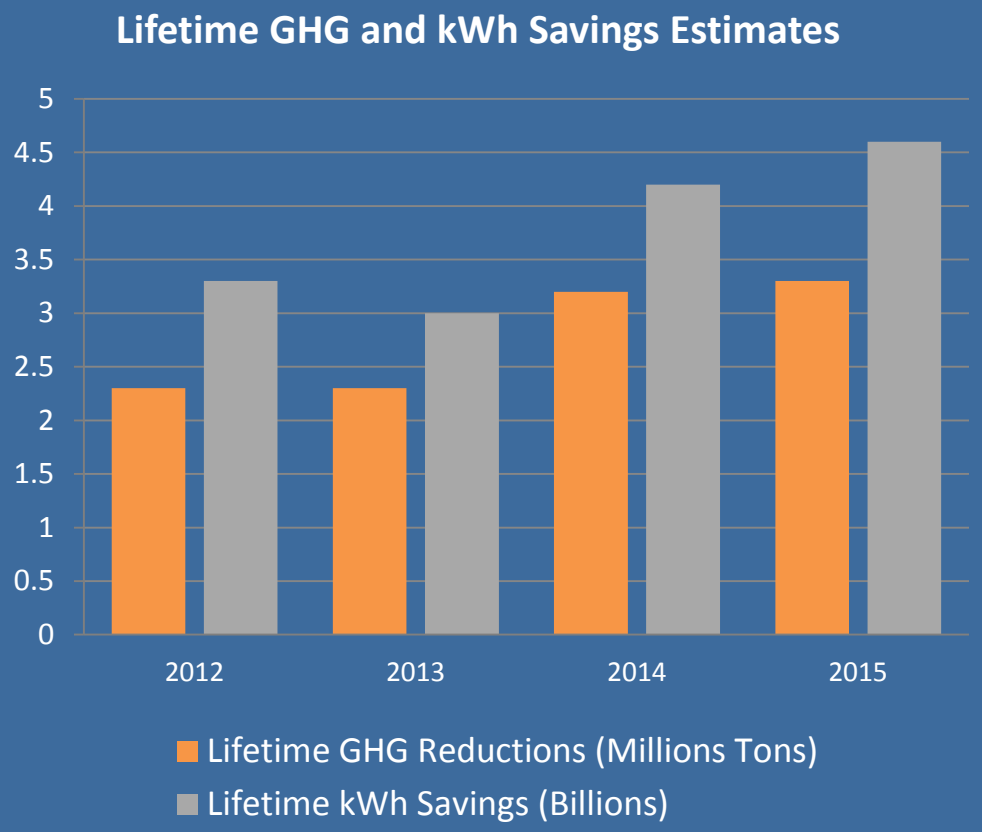
The forecast minus anticipated EE growth beyond FCM years

Source: Final ISO New England EE Forecast for 2019-2024 (April 2015)

Progress on Deploying Energy Efficiency in CT

In 2015 alone:

- **$222M** invested
- **$968M** lifetime energy costs saved
- **980k+** households served
- **6,300** businesses served
- **38.8M** lifetime CCF natural gas savings
- **4.6B** lifetime kWh savings
- **3.3M** lifetime tons GHG emissions reduced



Source: Connecticut Energy Efficiency Fund, Annual Programs and Operations Reports

Grid Integration of Buildings As Energy Resources

- Empowering individuals and businesses to recognize the opportunity and receive value of demand response, distributed generation, and energy storage

Benefits:

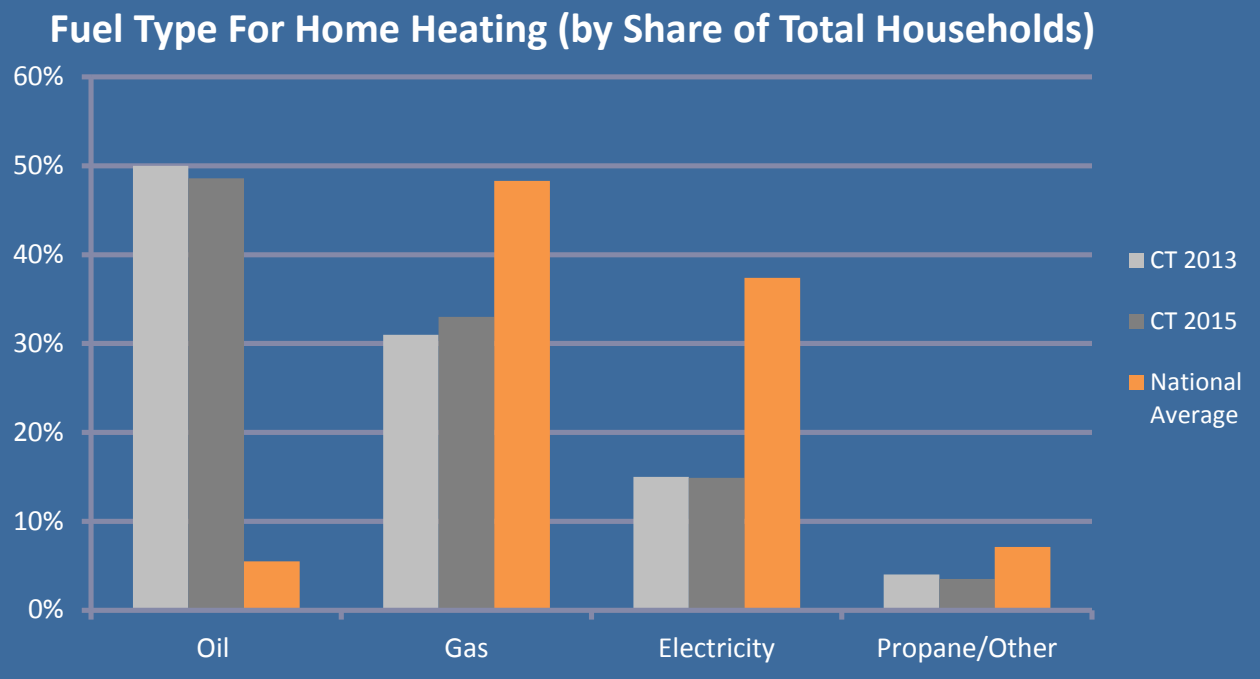
- Reduces capacity needs
- Reduces transmission & distribution investments
- Contributes to a more resilient electrical grid

Challenges to Scaling Energy Efficiency

- Issues of funding availability and structure of funding
  - Stable versus flexible funding mechanism
  - Externalized costs of other energy sources make efficiency resource appear costly, requiring need for optimized mix of grants and financing to correct market imperfections
- Investment uncertainty due to energy price variability
- Limited use of standardized monitoring and verification tools
- Lack of consumer awareness and inconsistent valuation of savings opportunity
- Need to better target segment-specific barriers
  - Access to capital in some sectors
  - Competing investment opportunities
  - Impediments to weatherization

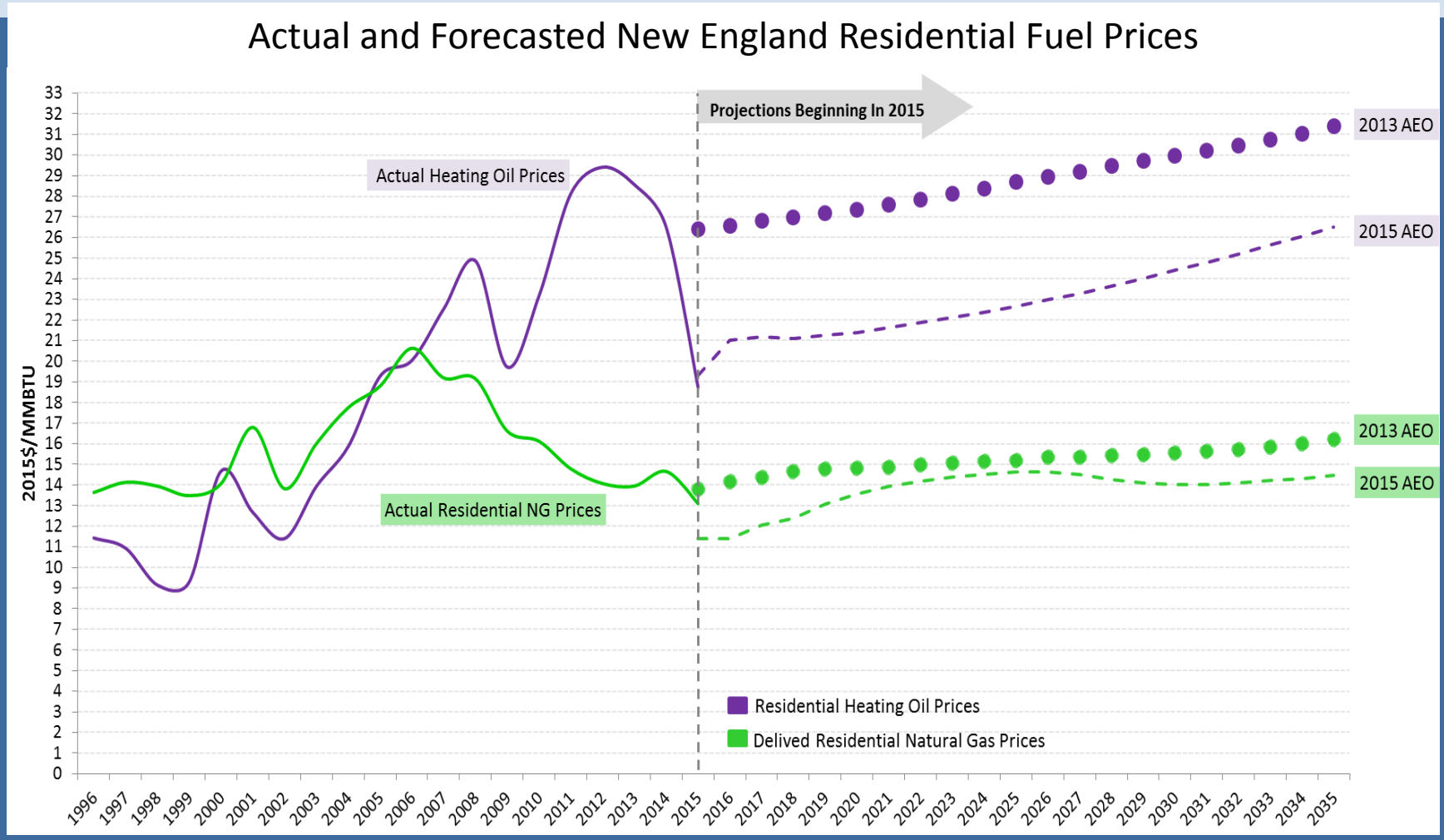
Creating Opportunities for Cheaper, Cleaner, More Reliable Thermal Energy in CT

Decreasing our reliance on fossil fuels for heating creates significant opportunity to lower costs, reduce emissions, and increase reliability through efficiency and fuel supply choices.



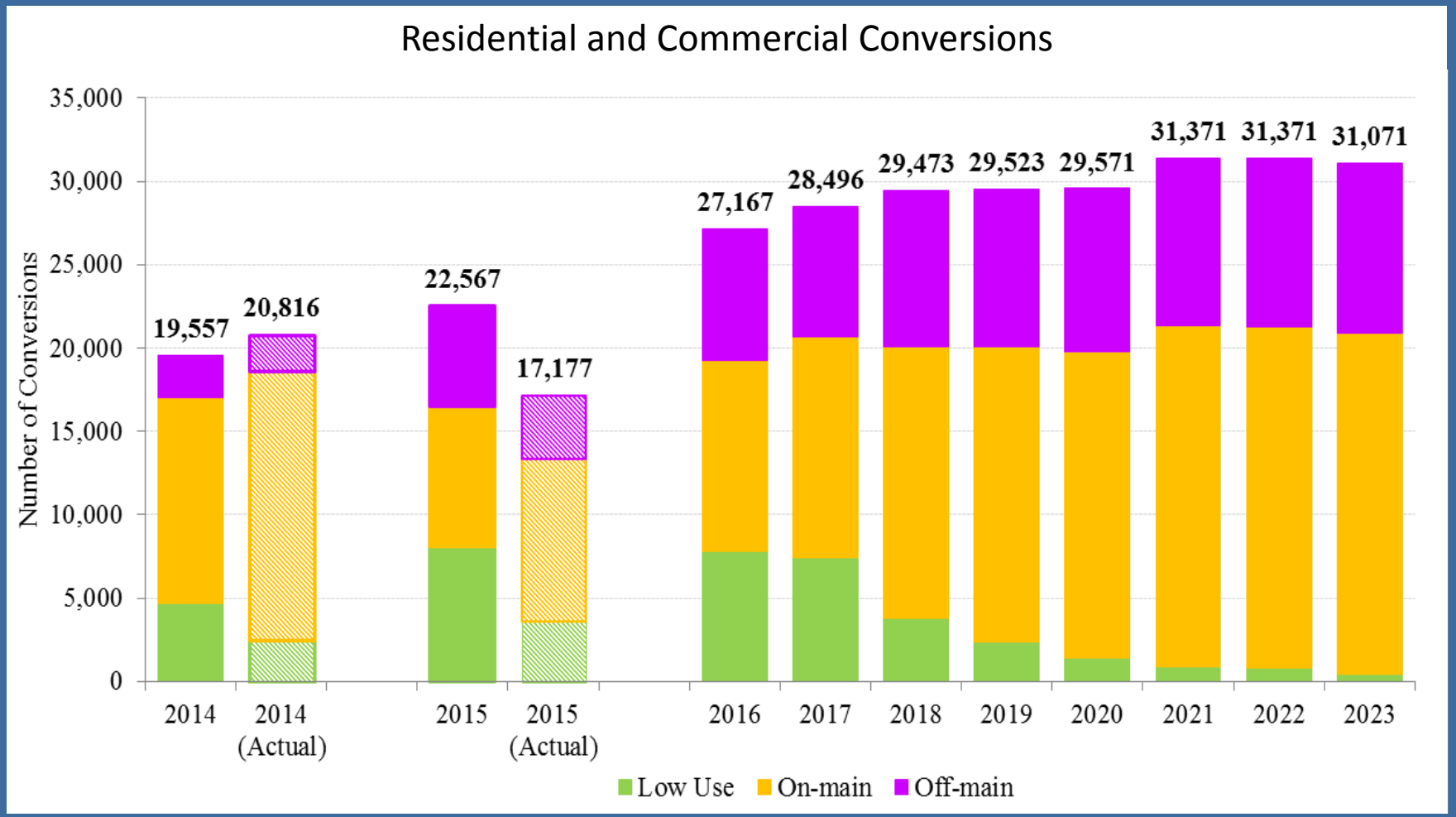
Sources: EIA Connecticut Data, 2013
DEEP Natural Gas Expansion Conversion Analysis, 2015

Changes in Natural Gas and Oil Price Projections



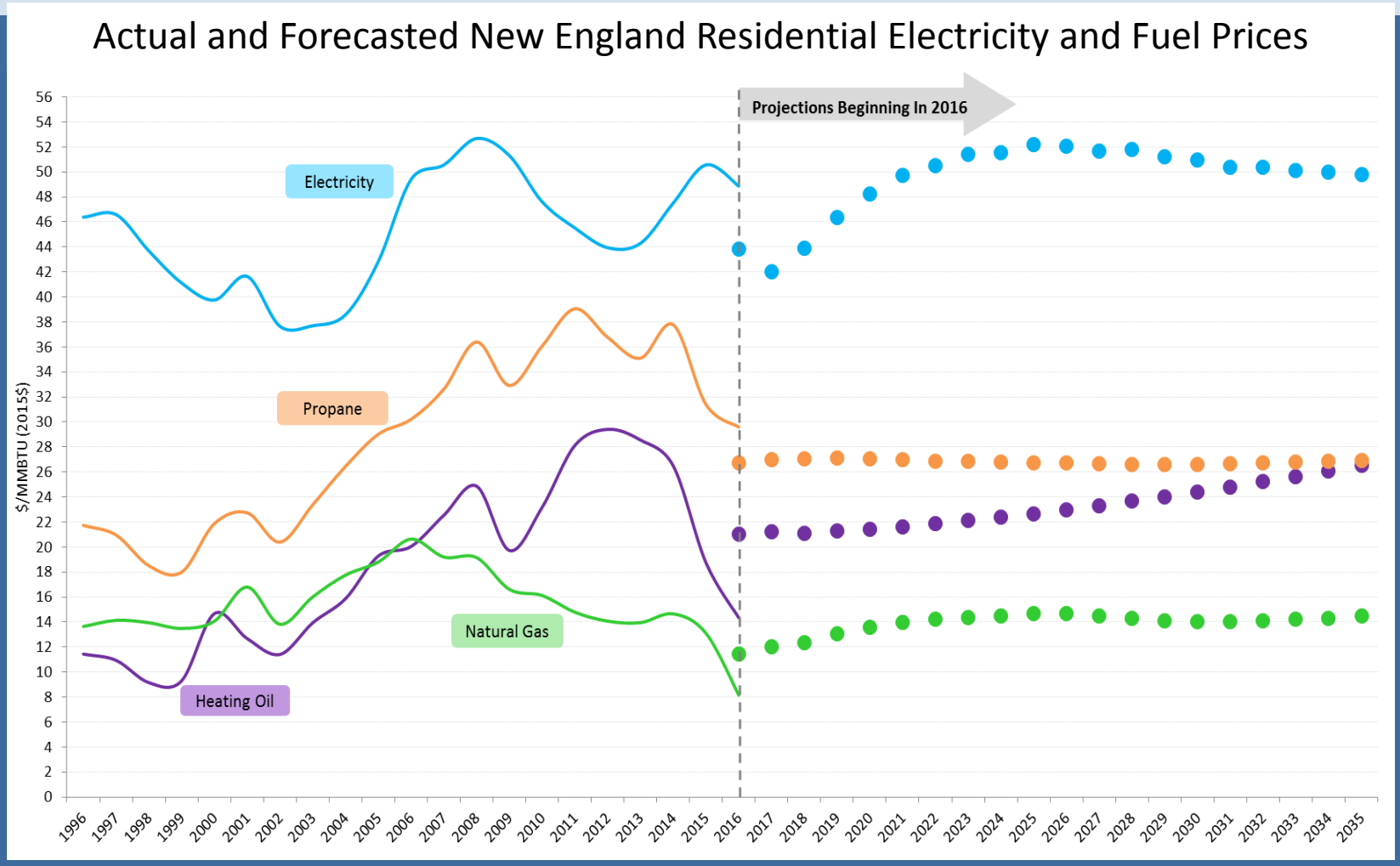
Source: Prepared by DEEP with actual and forecasted price information from EIA. Prices were extracted in nominal terms and then recalculated to 2015$. Actual Prices through 2015 with 2013 AEO and 2015 AEO Price Projections through 2035.

Status of Natural Gas Expansion Program



Source: Data from DEEP Data Request, LDC Monthly Residential and Commercial/Industrial Natural Gas Conversions and from PURA Docket No. 13-06-02RE01, Final Decision - Order 1 Compliance Filings

Residential Fuel & Electricity Prices



Source: Prepared by DEEP with actual and forecasted price information from EIA. Prices were extracted in nominal terms and then recalculated to 2015$. Actual Prices through 2016 with 2015 AEO Residential Price Projections through 2035.

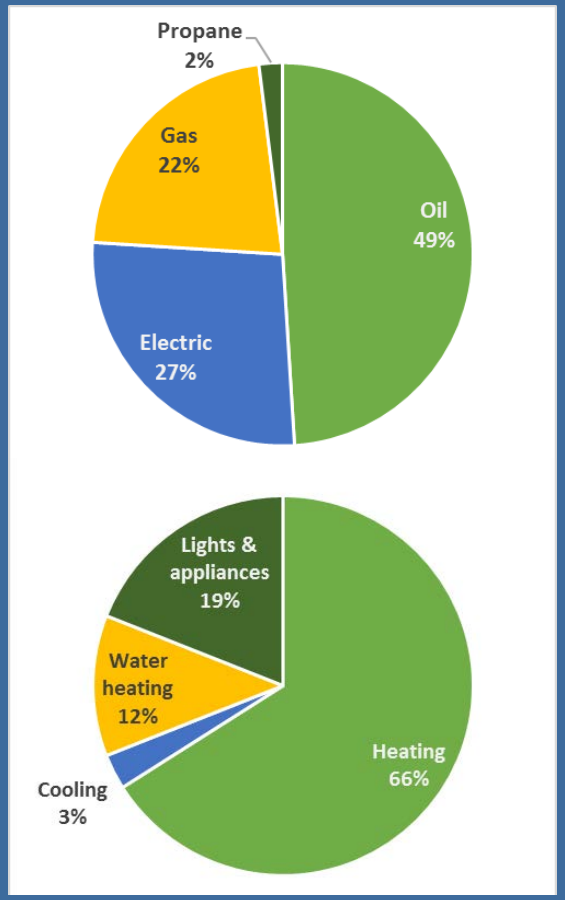
Creating Opportunities for Cheaper, Cleaner, More Reliable, & More Sustainable Thermal Energy in CT

Technology options exist to heat and cool buildings at a much lower cost and lower environmental impact

- Electrification
  - Ductless heat pumps
  - Ground source heat pumps
  - Air source heat pumps
- Geothermal heat pumps
- Natural gas conversion
- Solar hot water

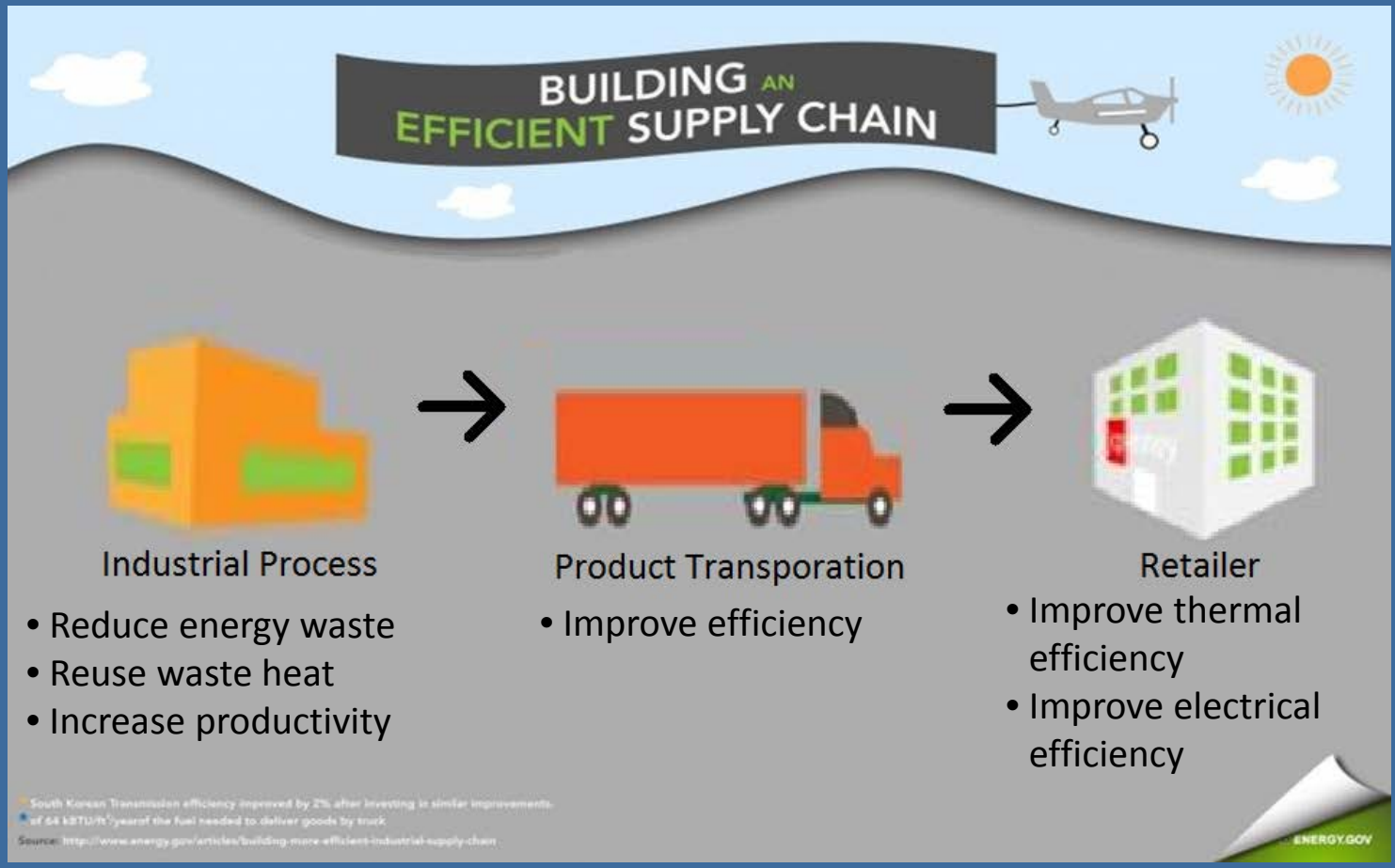
How do we ensure ratepayers can access the most effective option for them that also makes progress towards CT's climate goals?

Baseline Consumption by Fuel Type and End Use (Single Family)

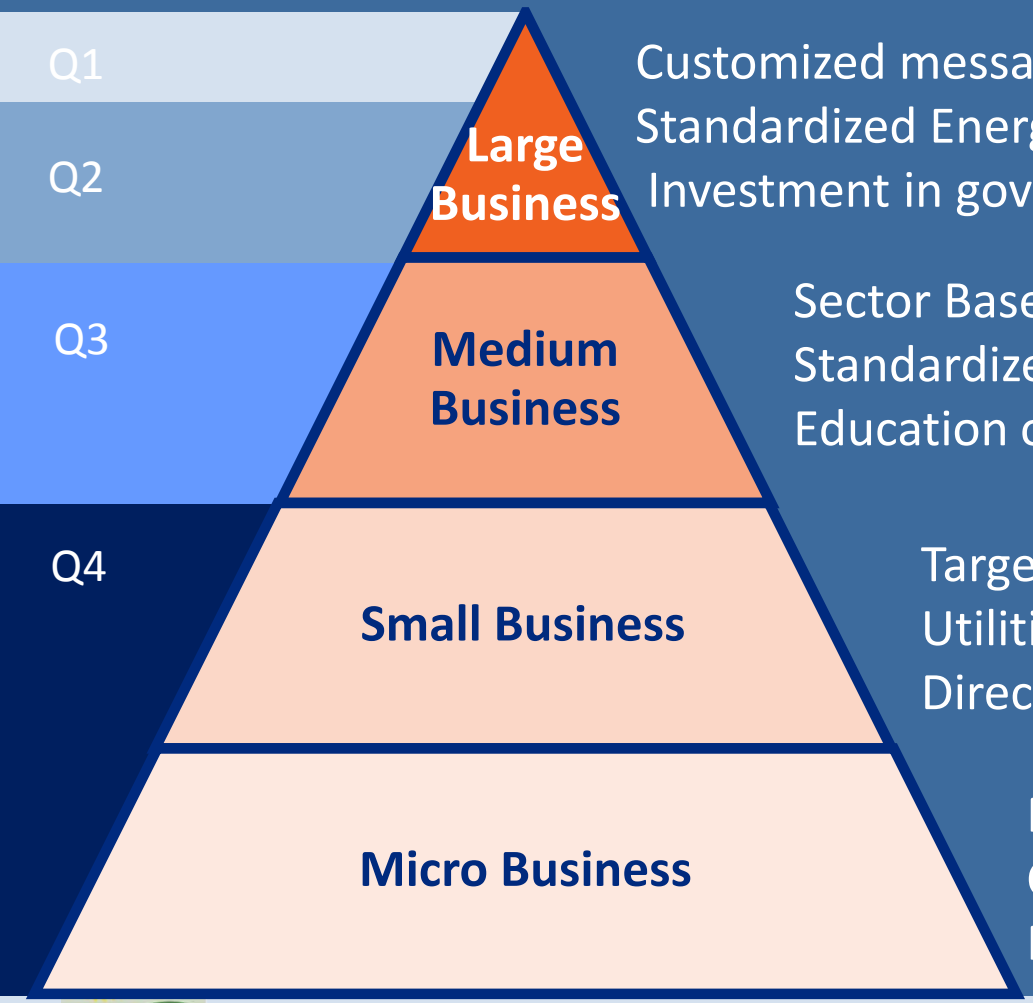


Source: R15 Single Family Potential Study, CT Energy Efficiency Fund (Draft)

Increasing Connecticut's Energy Productivity and Economic Competitiveness



Customizing Energy Solutions for Businesses & Industry



Customized messages and agreements
Standardized Energy Plan Roadmaps
Investment in government buildings

Sector Based Strategy
Standardized approaches for key industrial processes
Education of Vendors

Targeted Marketing
Utilities customer engagement platform
Direct Installation of certain measures

Mass Marketing
Customer engagement platform
Rebates

Source: Eversource 2015

2016 CES Scoping

1. What policies and mechanisms can be used to achieve scale and animate markets for energy conservation?

a. To what extent are building codes, appliance standards, and other regulatory requirements contributing to energy savings in buildings?

b. What are the relative costs and benefits (to participants, ratepayers, and society) of existing energy efficiency programs?

c. What are the key barriers for specific customer segments to reduce their energy usage, and how should they be addressed?

d. What, if any, new opportunities for measurement and verification should be used to achieve greater value for residents and facilitate scalability?

e. How do we help building owners communicate the value of their efficiency investments in real estate transactions?

f. How should we optimize the use of grants and financing to achieve the greatest savings at the least cost to ratepayers?

2016 CES Scoping

2. What policies and mechanisms can be used to fully capture the value for active energy efficiency and management measures [demand response; onsite generation/storage; smart appliances; grid modernization]?

a. What are the barriers to scaling distribution of these technologies?

b. How do we increase consumer awareness of the total benefits that active energy efficiency provides?

c. What are the costs (installation, operation) to consumers for active conservation, and, if they are barriers, what funding mechanisms do we have available?

d. What are the roles end-use consumers play in catalyzing grid modernization?

2016 CES Scoping

3. *What strategies should be put in place to reduce heating and cooling costs for Connecticut families and businesses and further decarbonize the energy used for heating?*

a. What are the relative costs and benefits for customers from heating and cooling with different types of fuels (heat pumps, electric resistance, oil, gas, propane), including both the installed costs of equipment and operating/fuel costs? How well is the Natural Gas Expansion Plan performing in providing access to natural gas for customers who want to switch to that fuel?

b. What are the opportunities to increase thermal efficiency in buildings?

c. What are the potential barriers to deployment of low-carbon thermal options, and what incentives might be appropriate?

d. How do we more effectively reach specific segments (Low-Income, Multi-family, small business etc.) and what kind of funding mechanisms can we utilize?

2016 CES Scoping

4. *What strategies should be put in place to reduce emissions and reduce costs of industrial processes in Connecticut?*

a. How can industrial processes be made more efficient?

b. How can we integrate solutions for other public policy challenges with energy solutions?

c. How can we recover energy waste in our water, wastewater, and waste infrastructure through better policy choices?

d. What are the opportunities for waste heat recovery, including combined heat and power generation, and how can we promote these technologies?

e. How do we enable different industry segments to utilize the optimal fuel, recognizing that different processes have different fuel requirements?

2016 CT Comprehensive Energy Strategy (CES)

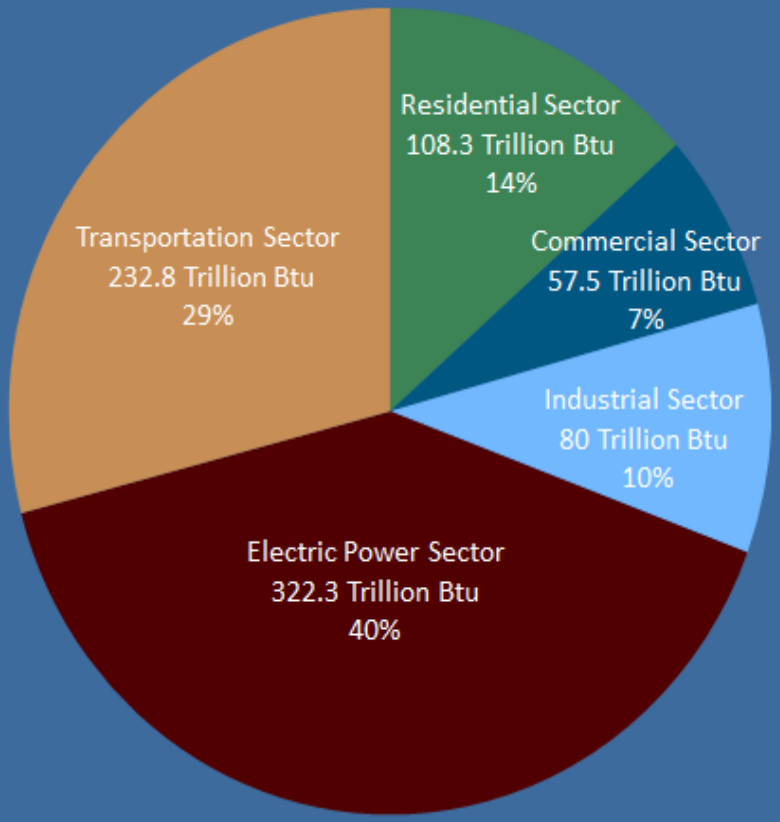
Agenda for Public Scoping

- Background of the CES Proceeding; Objectives for Scoping
- Tentative Schedule for 2016 CES Proceeding
- Organization of the 2016 CES
- Guiding Principles for 2016 CES
- Public Scoping: Key Topics; Initial Data; Research Questions
  - Electricity Sector
  - Buildings & Processes Sector
  - Transportation Sector
- Next Steps

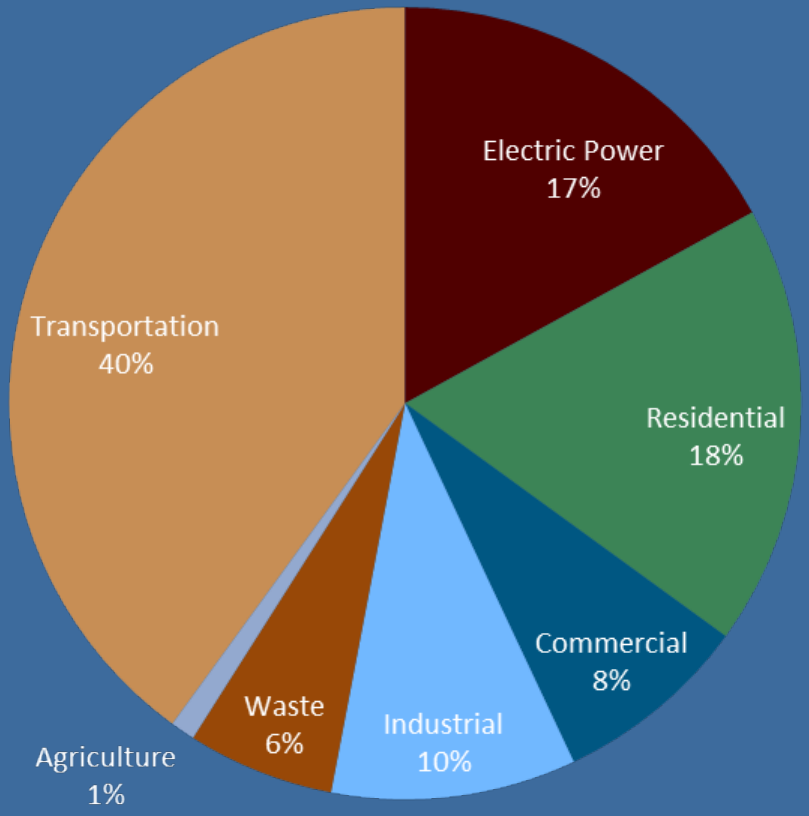
Transportation Sector

Transportation Sector

CT Energy Consumption by Sector, 2012



CT GHG Emissions by Sector, 2012



Connecticut Department of Energy and Environmental Protection

rces: U.S. En

Transportation Sector

Federal and State Standards

Corporate Average Fuel Economy (CAFE)	National Highway Traffic Safety Administration (NHTSA) and Environmental Protection Agency (EPA) issued joint final rules to further improve fuel economy and reduce greenhouse gas emissions for passenger cars and light trucks. CAFE Avg for 2016-35.5 MPG
Low Emission Vehicle (LEV) Standards Passenger Vehicles	CT LEV II Program requires that all new vehicles sold in Connecticut meet California emissions and compliance requirements. 2017 CA requirements expand additional automakers.
Phase 2 standards Medium & Heavy Duty-Vehicles	Standards for medium and heavy-duty vehicles would improve fuel efficiency and cut carbon pollution. Standards are proposed to take effect with MY 2018-27
Renewable Fuel Standard	EPA established the RFS program as the first renewable fuel volume mandate in the U.S. RFS program was expanded in 2007 under Energy Independence and Security Act (EISA) to include: • Increased target of 36 billion gallons of renewable fuel by 2022, up from 9 billion gallons in 2008; • New categories of renewable fuel, including cellulosic biofuel and biomass-based diesel, and separate volume requirements for each; • New life cycle greenhouse gas performance threshold.

Transportation Sector

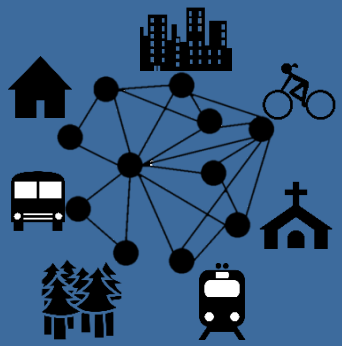
Key Components

Passenger Vehicles and Light-Medium Duty Trucks

Current State: 95% Vehicle Stock and 70% Energy Consumption

Fuels

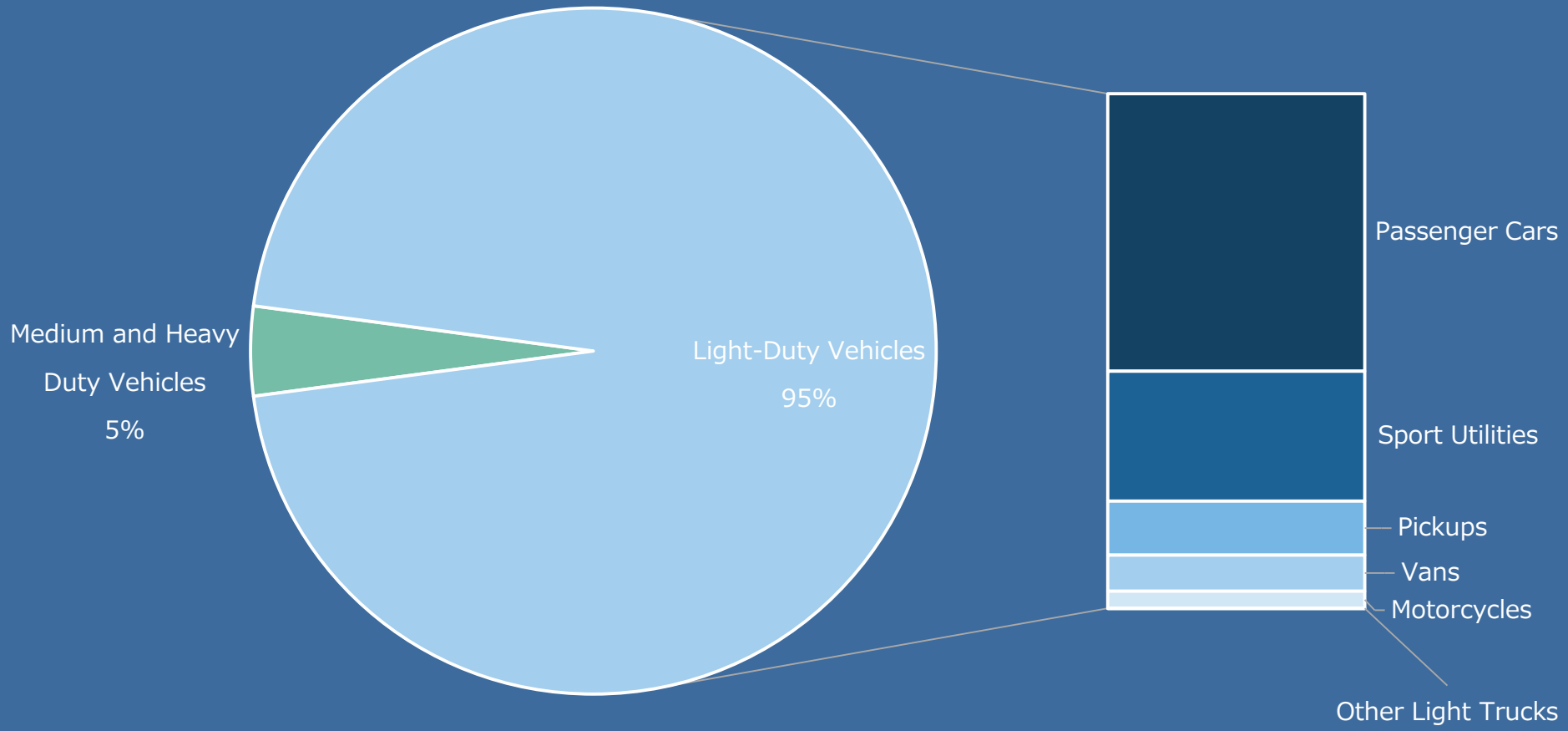
Current State: 99.5% Oil and Gasoline



Transportation System Efficiency

Transportation Sector

Connecticut Vehicle Registrations, 2013

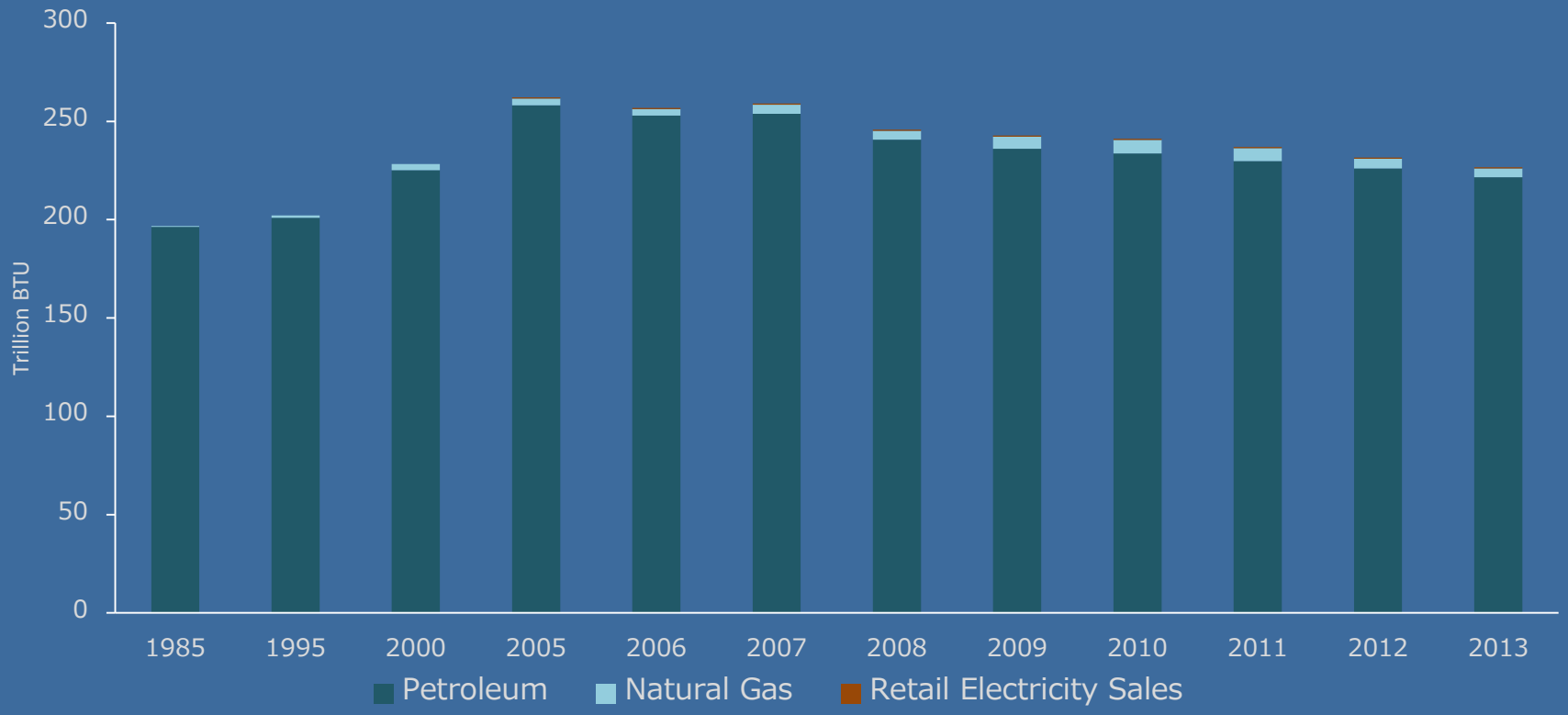


Source: Atlas Public Policy and Cadmus Group analysis

CT Transportation Sector

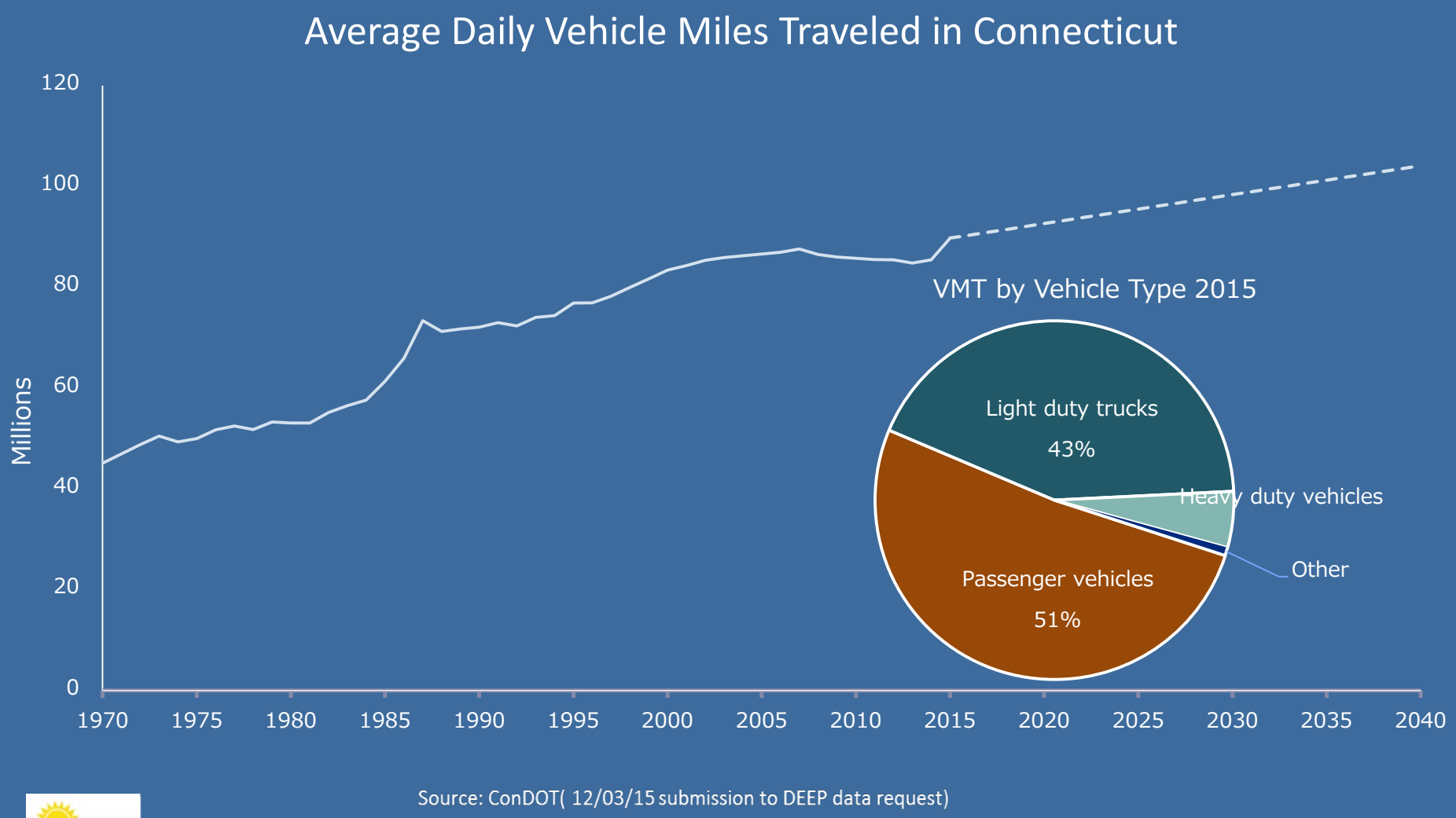
Fuel Mix

Connecticut's transportation sector remains largely reliant on petroleum products as the primary fuel source.



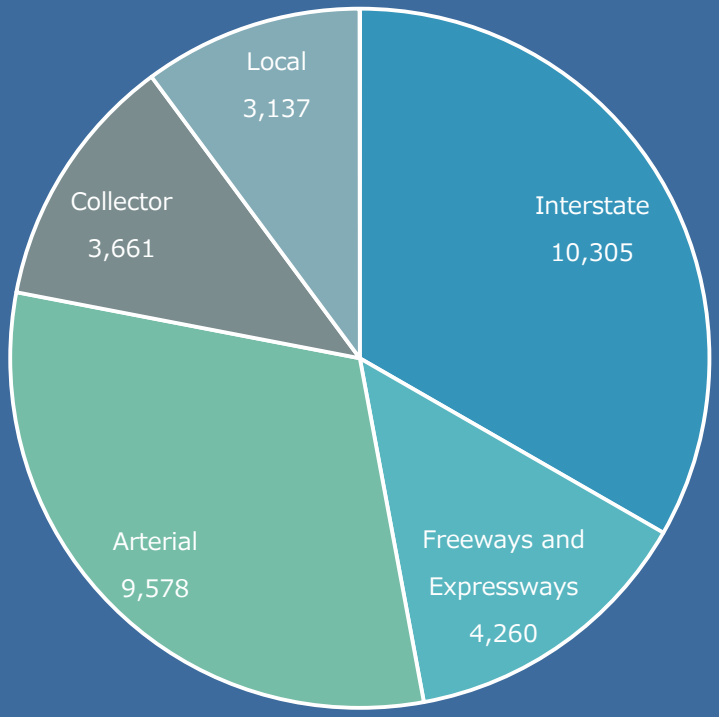
EIA State Energy Data System. **Table CT7. Transportation Sector Energy Consumption Estimates, 1960-2013, Connecticut**
http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_use/tra/use_tra_CT.html&sid=CT

Transportation Sector



Source: ConDOT(12/03/15 submission to DEEP data request)

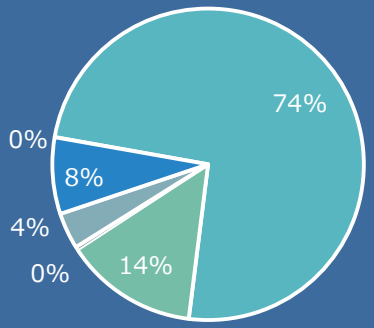
Transportation Sector



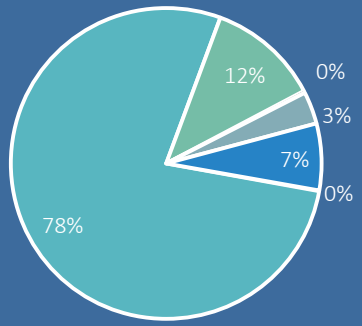
Annual vehicle miles traveled on Connecticut roads in million miles in 2013

Most travel in Connecticut occurs on major roadways (interstates, freeways/expressways, and arterials).

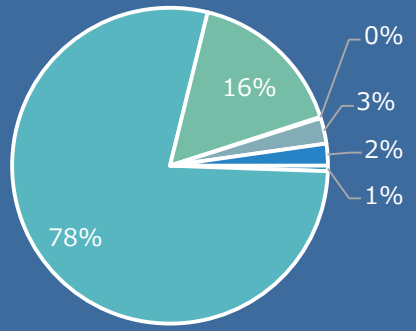
Interstate System



Other Arterials



Other

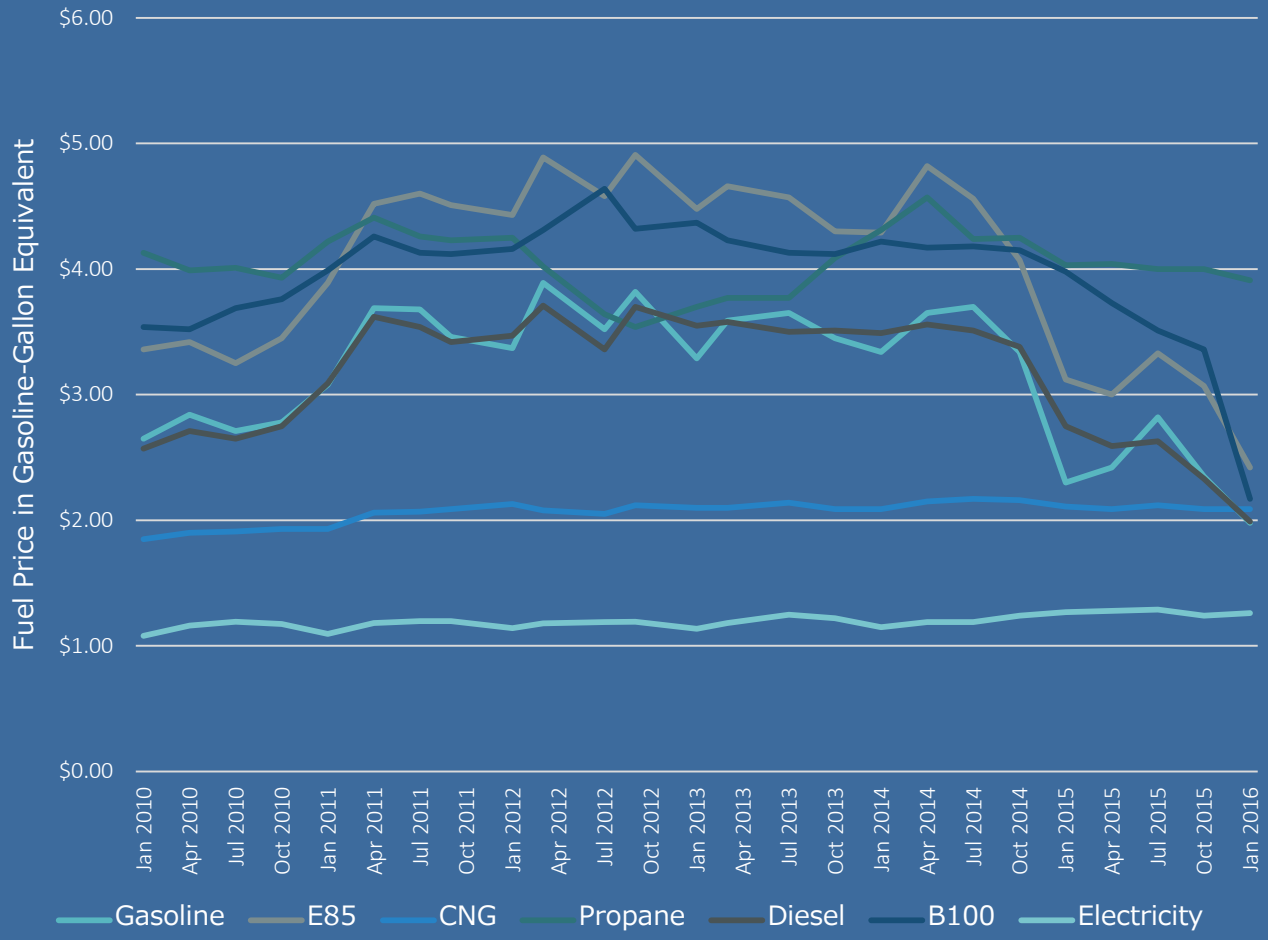


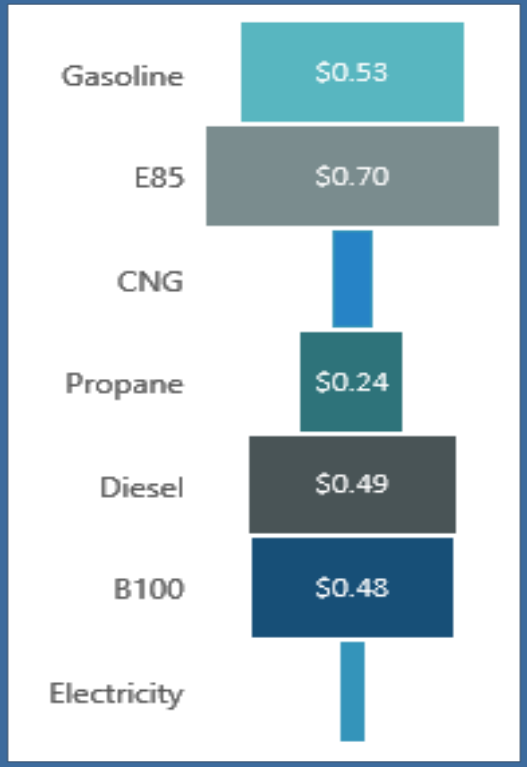
Motorcycles
Buses
Passenger Cars
Single-Unit Trucks
Light Trucks
Combination Trucks

Source: Federal Highway Administration, "Highway Statistics Series" http://www.fhwa.dot.gov/policyinformation/statistics/2013

Transportation Sector

National Transportation Fuel Prices in Gasoline-Gallon Equivalent

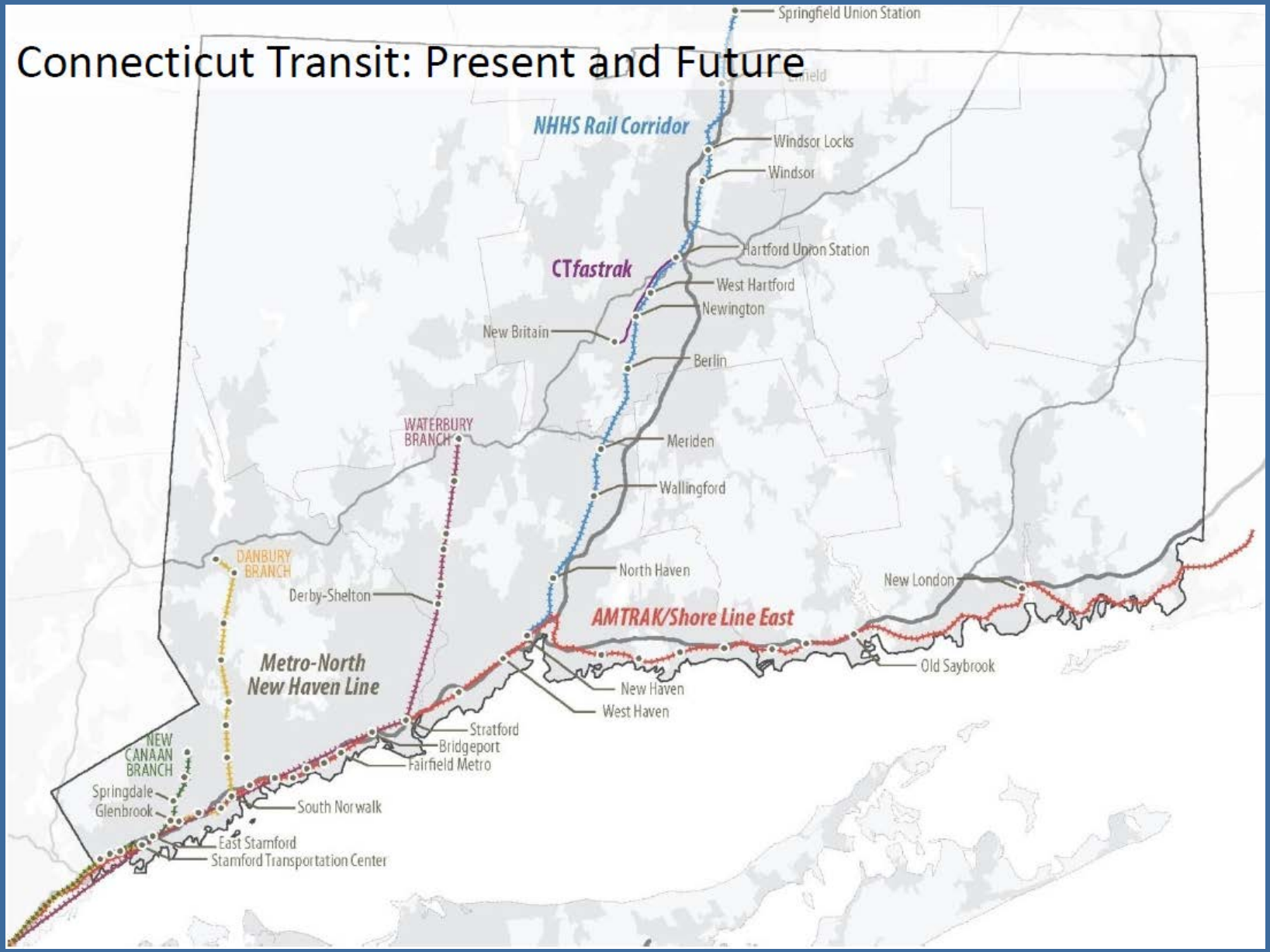




National prices are shown on the left. Price volatility, a way to measure the extent to which a price changes over time, is shown on the right. The volatility is the amount by which prices deviated from the average price from January 2010 to September 2015.

Source: U.S. Department of Energy, "Retail Fuel Prices with Electricity http://www.afdc.energy.gov/uploads/data/data_source/10326/10326_retail_fuel_prices_with_electricity.xlsx

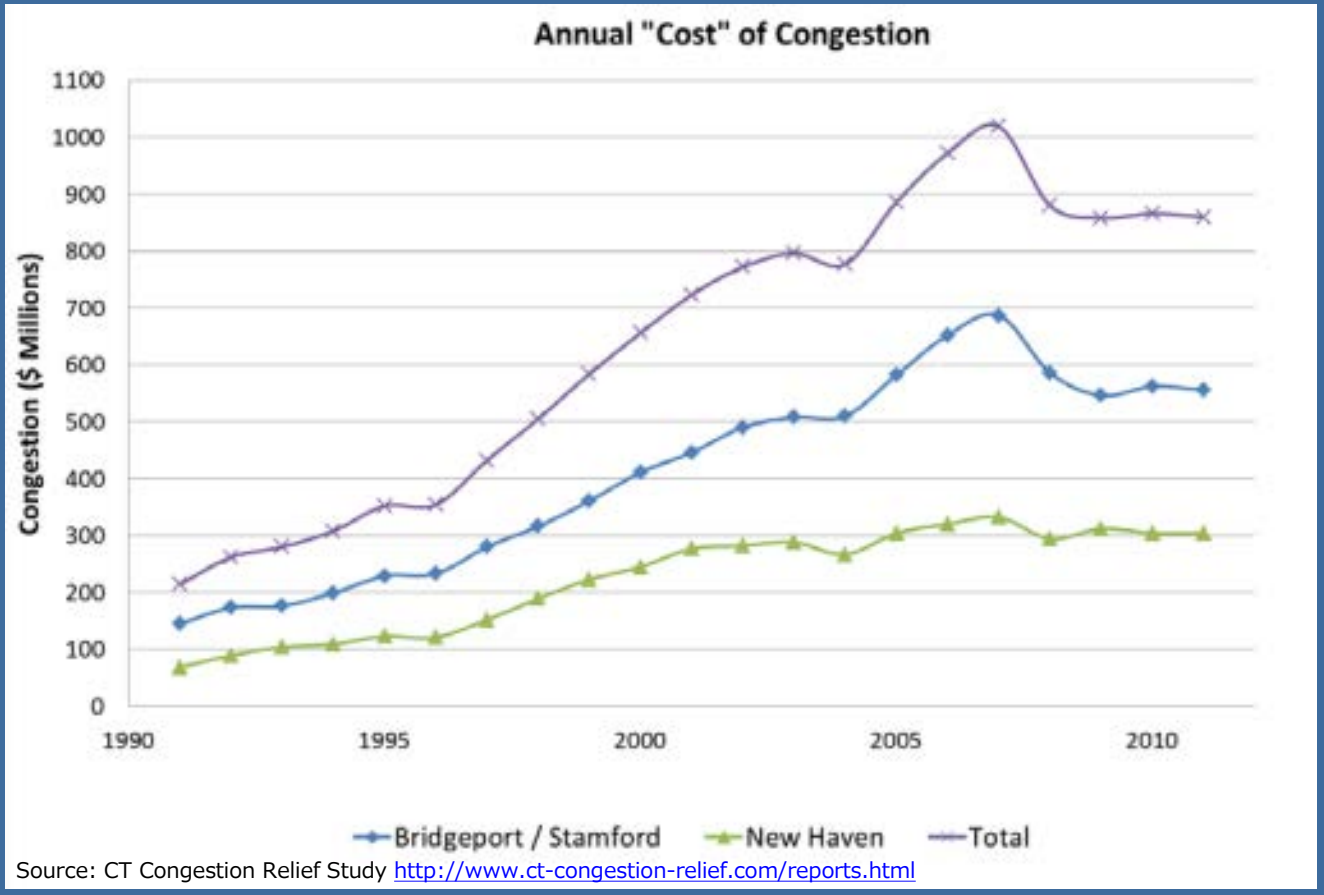
Transportation Sector



Source: Office of Policy and Management

Transportation Sector

Annual Cost of Congestion



Source: CT Congestion Relief Study http://www.ct-congestion-relief.com/reports.html

Urban Area	Average Cost of Congested-related Delays per Driver	Average Number of Hours Wasted in Traffic
Bridgeport/ Stamford	$1,174/year	49 hours/year
Hartford	$1,038/year	45 hours/year
New Haven	$932/year	40 hours/year

Source: TRIP "Connecticut's Top Transportation Issues: Meeting the States Needs for Safe, Smooth, and Efficient Mobility." November 2015

*Dollar value of total annual cost of congestion represents the total annual cost of traffic congestion in the metropolitan areas of New Haven and Bridgeport/Stamford.

Transportation Sector

Percentage of median household income spent on Transportation.

County	Income spent on transportation	Housing	Remaining income
Fairfield	16%	36%	48%
Hartford	19%	29%	52%
Litchfield	21%	31%	48%
Middlesex	21%	34%	45%
New Haven	21%	34%	45%
New London	21%	30%	49%
Tolland	22%	31%	47%
Windham	23%	28%	49%
US Average	17%	33%	50%

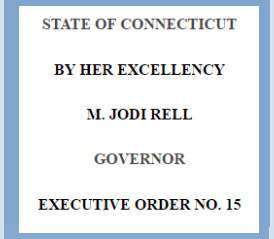
Source: *Center for Neighborhood Technology's Housing and Transportation (H+T) Affordability Index* http://htaindex.cnt.org/
Source US Average: *Consumer Expenditures – 2014, U.S. Bureau of Labor Statistics (9/3/2015)*

Climate Action and Transportation Policy Drivers

CT releases its 2005 *Climate Change Action Plan*

2005

Governor Rell issues Executive Order 15 establishing the Office of Responsible Growth within the Office of Policy and Management.


STATE OF CONNECTICUT

BY HER EXCELLENCY

M. JODI RELL

GOVERNOR

EXECUTIVE ORDER NO. 15

2006

CT Global Warming Solutions Act (Public Act 08-98) reaffirms commitment to GHG targets for 2020 and 2050


STATE OF CONNECTICUT

Substitute House Bill No. 5600

Public Act No. 08-98

AN ACT CONCERNING CONNECTICUT GLOBAL WARMING SOLUTIONS.

2008

Adoption of the Low Emission Vehicle (LEV) Standards

2009

US EPA approves waiver allowing California GHG emissions standard for cars to be implemented in the 14 states in which it was adopted, including CT

CT is one of 11 states to launch the Transportation & Climate Initiative

2010

2013

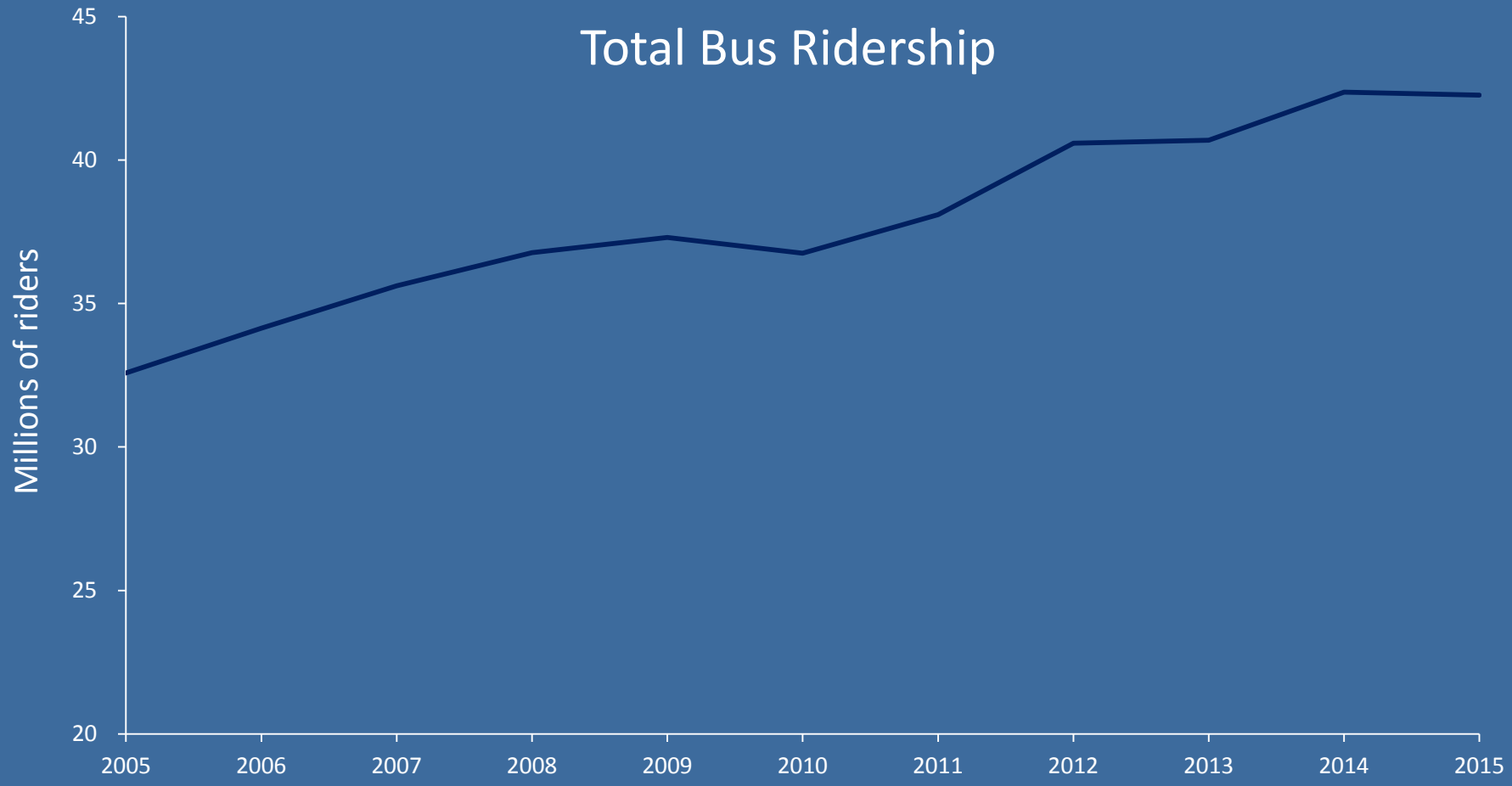
CT signs onto Zero Emission Vehicles MOU with 7 other states.

Governor Malloy issues Executive Order 46 establishing the Governor's Council on Climate Change (GC3)

Executive Order 46

2015

Performance of Existing Programs

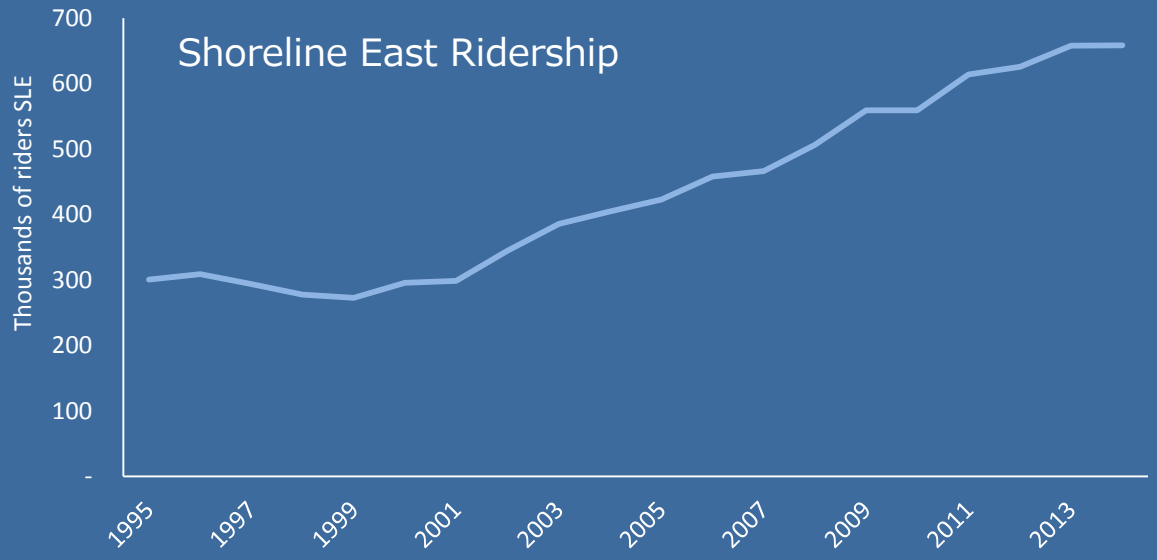


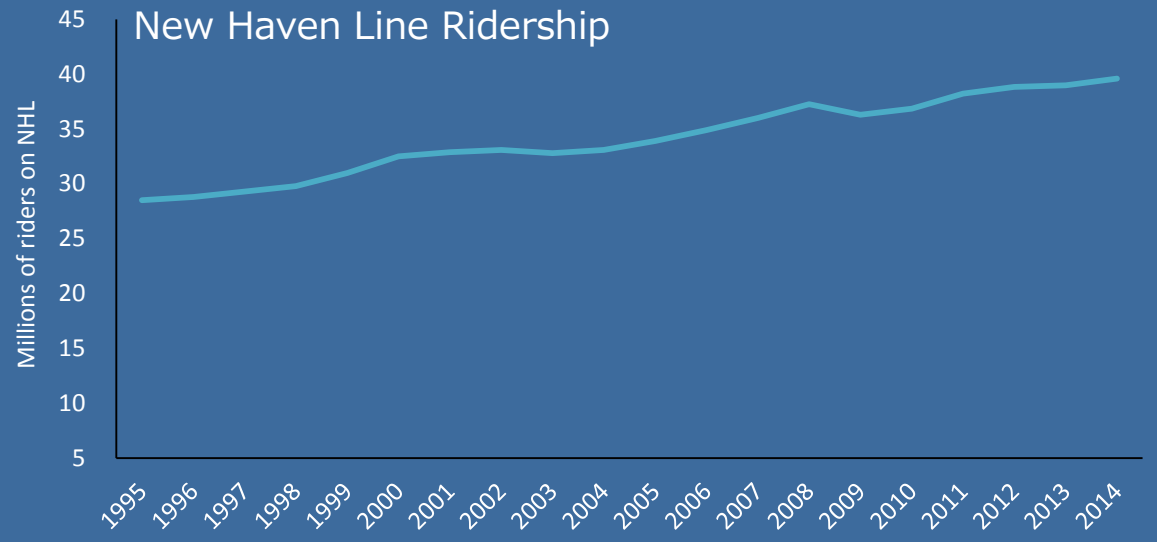
*Total ridership numbers include fixed route, express, ADA paratransit, dial-a-ride, and rural services.

Source: ConDOT (4/8/16 Submission to DEEP data request)

Performance of Existing Programs

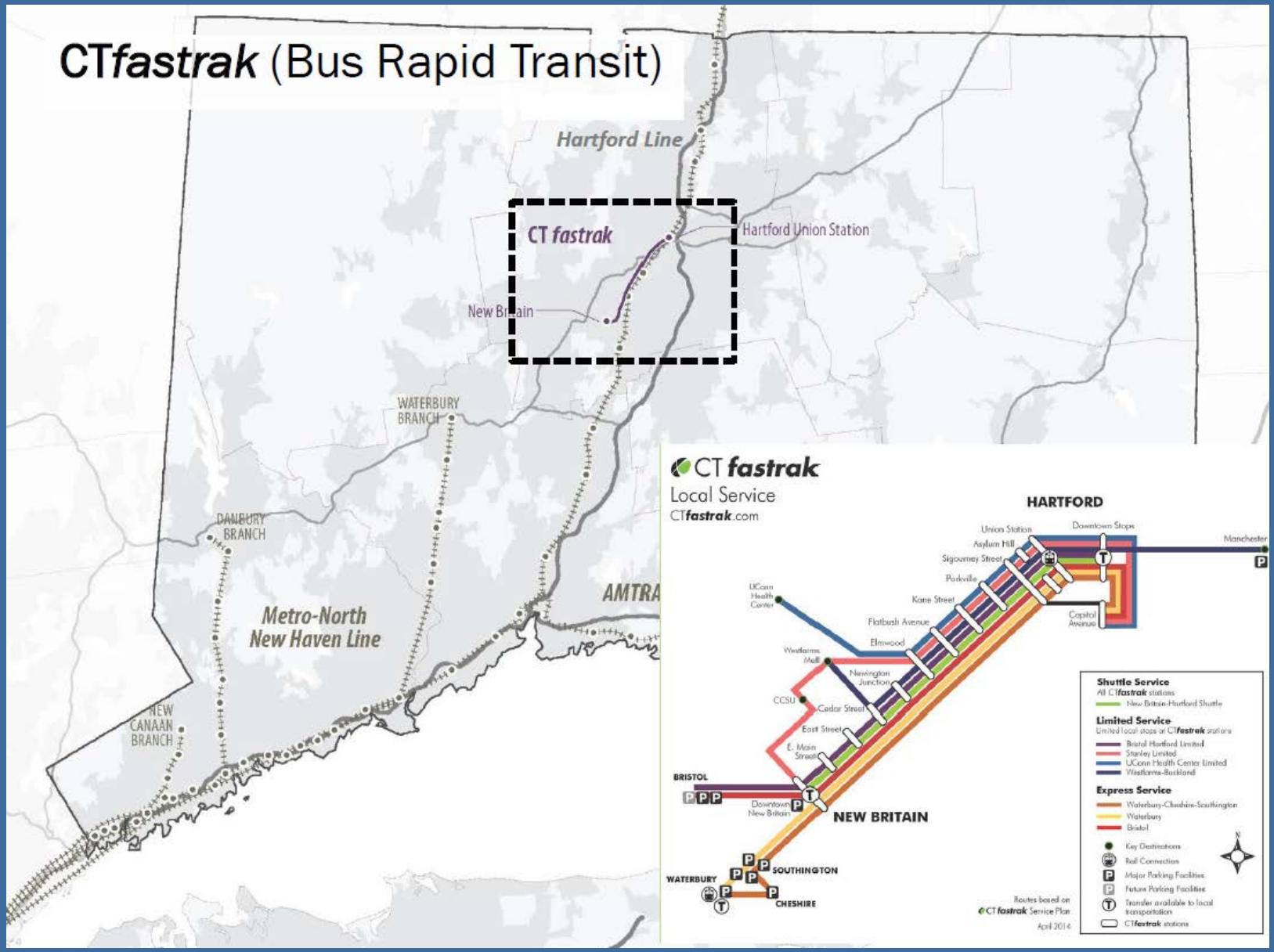
Ridership trends on the Shore Line East and New Haven Lines





Source: DEEP data request to ConDOT

Performance of Existing Programs



Source: Office of Policy and Management

Performance of Existing Programs

Financial and Planning Assistance for Transit Oriented Development:

$15 million TOD Acquisition and Pre-Development Loan Fund

- Administered by LISC (Local Initiatives Support Corporation); $2 million in state seed funding
- Max $3m loan, 5% interest, 3-year term max
- Project must be located within ½ mile of Ct*fastrak* or Hartford Line station
- Project must include a residential component with a min % of affordable housing

CTDOT Planning Assistance

- $700,000 grant from FTA's Pilot Program for TOD Planning, for the new Hartford Line rail system
- $250,000 state funded TOD planning assistance for Ct*fastrak* corridor

OPM Funding for Capital and Planning

- Awarded $1.5 million in TOD planning grants to eleven municipalities in 2015
- TOD/Responsible Growth Grant Program application period closed February 4, 2016
- $15 million TOD bond authorization, with additional funds requested in this biennial budget
- $15 million Responsible Growth Fund authorization

Source: Office of Policy and Management

Performance of Existing Programs

Funding for Charging Infrastructure

Public Fleet EV and Public Workplace EV Charging Station Incentive

Application Period Closed on May 4, 2016

DEEP is offering a competitive funding opportunity for municipalities and state agencies to purchase EVs and/or to purchase and install EV charging stations at municipal and state agency facilities.

Utilizing funds made available through the Regional Greenhouse Gas Initiative (RGGI), DEEP will provide a reimbursement of up to $15,000 per vehicle and up to $10,000 per charger meeting the program guidance specifications, with a maximum of six EVs and chargers per grant recipient. These funds may also be designated for the installation of EV charging stations for use by employees and others - up to $10,000 for one dual-head or two single-head charging stations will be made available without the purchase of an EV. A town or agency that owns a commuter parking lot or other parking area where its employees or the public are allowed to park for 10 hours per day or longer, is eligible to obtain funding up to $2,000 for the purchase and installation of a two-outlet Level 1 EV charging station at that lot.

The overall goal for this program is to promote EV use by increasing the number of EVs in public fleets and by establishing more EV charging stations throughout Connecticut. DEEP will consider the cost effectiveness, the potential for timely completion and operation, and the overall economic benefits to Connecticut when selecting proposals for awards.

Program Documents

Announcement of Incentive Program

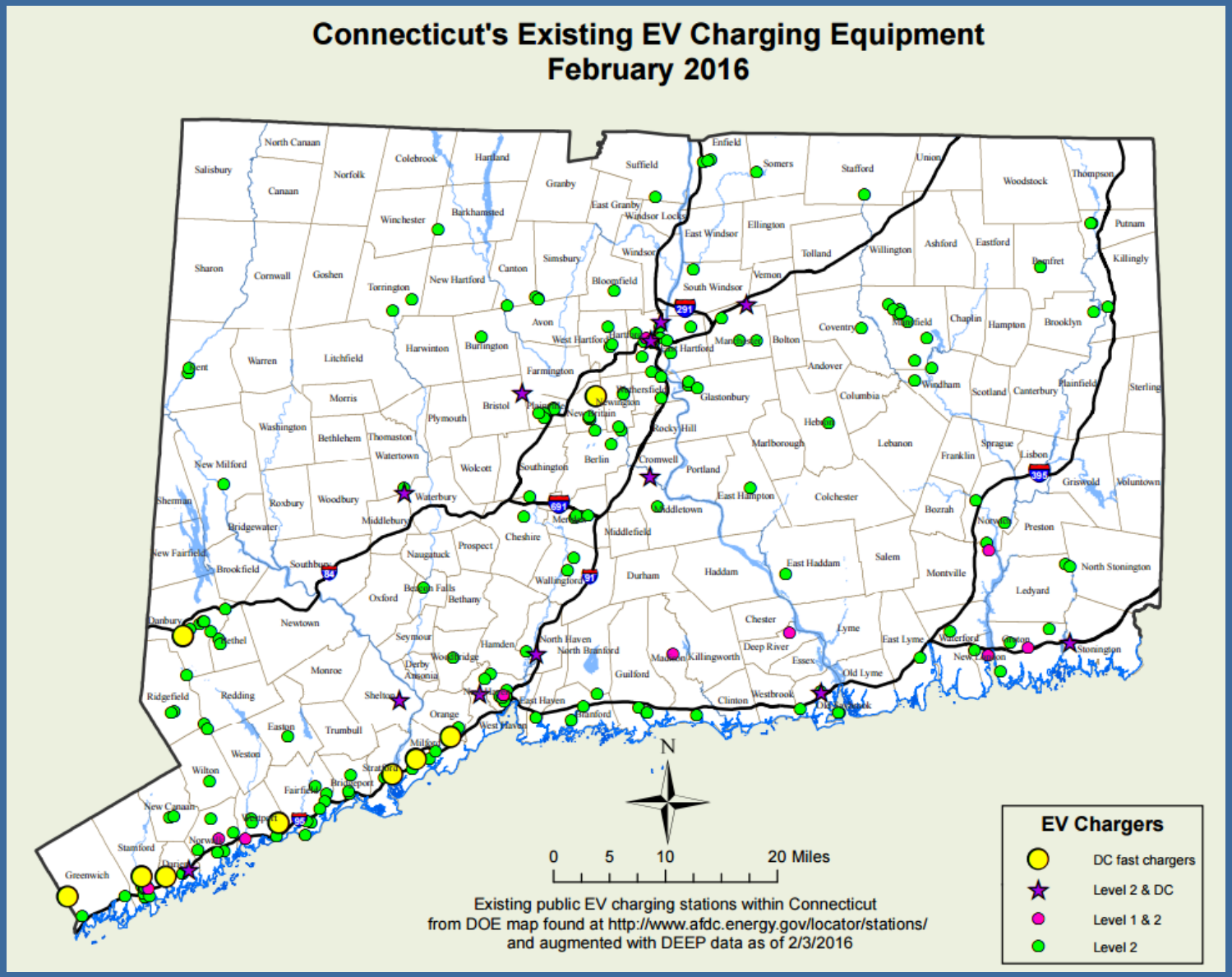
Criteria for Incentive Program

Incentive Proposal Form (PDF, MSWord)

Reimbursement Checklist & Signage Guidance (PDF, MSWord)

DEEP has administered 11 rounds of grant programs over the last three years to give money for the installation of charging equipment.

Performance of Existing Programs



2016

300 public EV charging stations

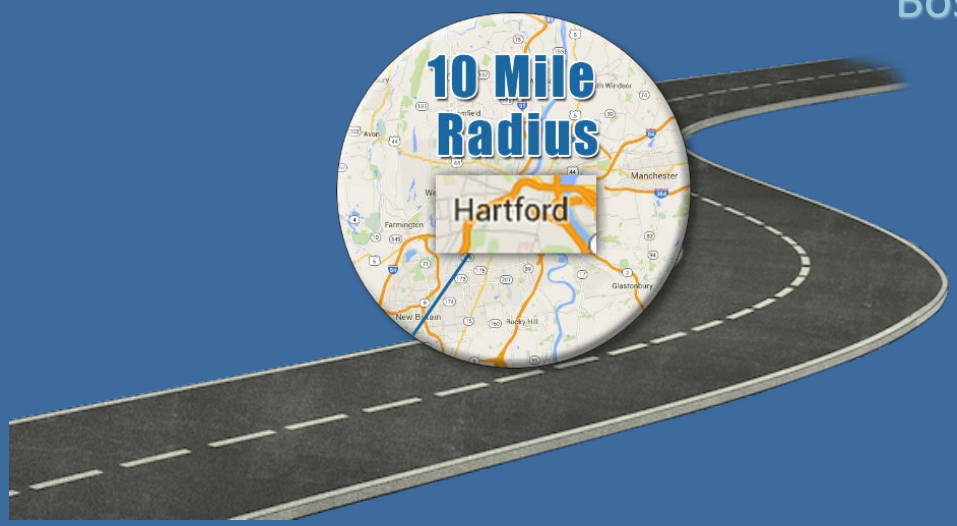
2013

Approximately 6 public EV charging stations

Performance of Existing Programs

Funding for H2 Fueling Stations

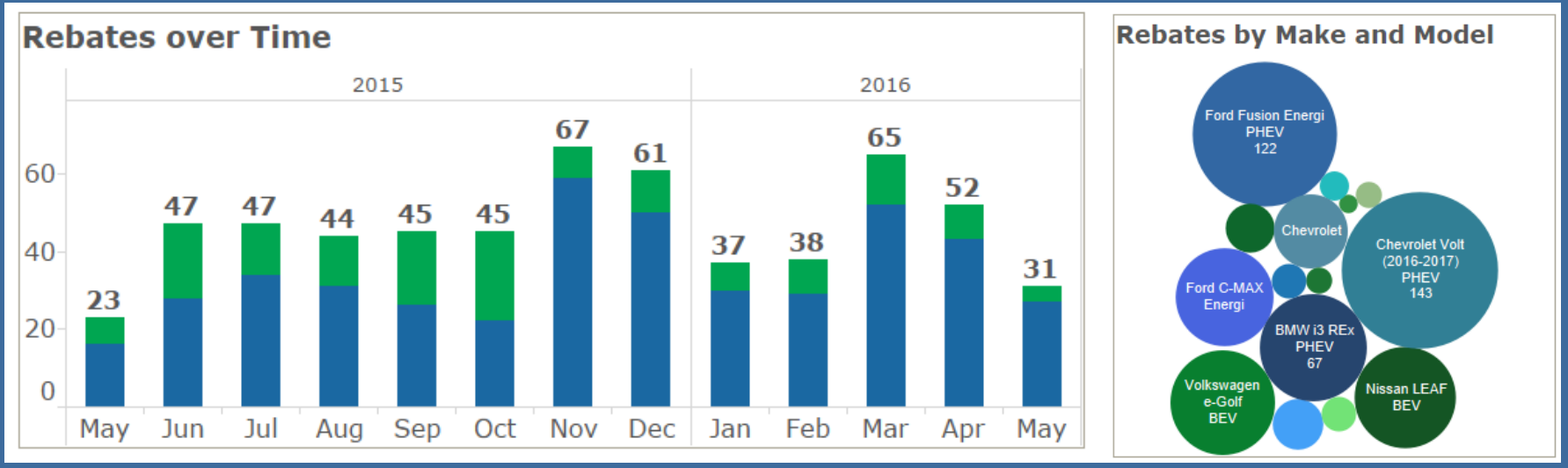
EVConnecticut's Hydrogen Fueling Stations (H2Fuels) Grant is being administered through the Connecticut Center for Advanced Technology, Inc. (CCAT). CCAT will award up to $450,000 to develop and operate two publicly available hydrogen fueling stations in the greater Hartford area.



Performance of Existing Programs

Funding for Zero Emission Vehicles: CHEAPR Program

Rebate Amount	Required Battery Capacity	Total Rebates
$3,000	Greater than 18 kWh or any fuel cell electric vehicle	346
$1,500	7 - 18 kWh	216
$750	Less than 7 kWh	15



Source: DEEP and Center for Sustainability Energy May 17, 2016
http://ct.gov/deep/cwp/view.asp?a=2684&q=565018

Performance of Existing Programs

Vehicle Registration in Connecticut 2009-2014

Year	Battery Electric Vehicles	Plug-in Hybrid Electric Vehicles	Sum of LDV Registrations
2009	11	0	2,132,408
2010	16	12	130,704
2011	31	97	152,056
2012	136	557	156,232
2013	536	1,225	159,831
2014	823	1,653	151,118
Grand Total			2,882,349

Source: Atlas Public Policy and Cadmus Group analysis

Emission Reduction Opportunities

Criteria for evaluating Cheaper, Cleaner, More Reliable and Sustainable Transportation in Connecticut

Near-term market feasibility: feasibility within the next five years based on vehicle availability and other practical considerations.

Environmental performance and petroleum displacement potential: the potential to reduce greenhouse gas and criteria pollutant emissions based on vehicles registered in Connecticut.

Cost-effectiveness: greenhouse gas emission abatement costs of using alternative fuel vehicles compared to diesel and gasoline vehicles considering upfront and operating costs.

Local economic benefits: estimates of potential benefits in Connecticut from greater use of an alternative fuel.

Transportation Sector

Ten alternative fuels that could replace gasoline or diesel fuel:

Fuel	Description
Battery-Electric:	On-board battery storage powered by the electrical grid or distributed electricity sources.
Biodiesel from waste oils	Liquid fuel produced through the transesterification of animal fats and waste oil and used in a diesel engine, blended with diesel at 5 percent (B5) to 100 percent (B100) by volume.
Renewable diesel	Liquid fuel produced through hydrotreating of oils or Fischer-Tropsch synthesis of biogas. Renewable diesel is typically not blended with conventional diesel like biodiesel. As a "drop-in" fuel, renewable diesel requires no new infrastructure.
E85	Liquid fuel produced from biomass (food- or waste-based) where up to 85 percent of the fuel is ethanol and 15 percent or more is gasoline, by volume.
Landfill/ wastewater gas	A mixture of mostly methane and carbon dioxide (CO_2) emitted from landfills and wastewater treatment plants. After processing to renewable natural gas (RNG), the gas is interchangeable with natural gas in an internal combustion engine.
Dairy biogas	Similar to landfill/wastewater gas in composition once processed to RNG. Slightly more expensive to collect than landfill/wastewater gas, but is a substitute for natural gas.
Propane	Also known as liquefied petroleum gas (LPG), propane is a clean-burning alternative fuel used mostly medium- or heavy-duty applications.
Compressed natural gas (CNG)	Compressed gas (mostly methane) combusted in an internal combustion engine and derived from fossil.
Liquefied natural gas (LNG)	CNG compressed and cooled until liquid and used in internal combustion engine.
Hydrogen (gaseous)	Compressed gaseous fuel typically used in a fuel cell to power an electric motor. The fuel can also be combusted in an internal combustion engine.

Source: Atlas Public Policy and Cadmus Group analysis

2016 CES Transportation Sector Questions

1. What strategies should the CES prioritize to enhance and increase alternative modes of travel (bike, walk, bus, train, carpool, telecommute)?

2. How should the CES support smart growth and transit-oriented development in urban areas? In transportation corridors and not in transportation corridors?

3. What strategies should the CES prioritize to facilitate a shift to alternative fuels for transportation?

2016 CES Transportation Sector Questions

4. How should the CES address the need for the balance between alternative fuel infrastructure with cost-related risks, rapidly evolving technology, accessibility, and consumer protection? What should the role of utilities be in deploying such infrastructure?

5. How can the CES best support reducing environmental impacts while increasing the efficiency of Connecticut's freight, rails, and ports?

2016 CES Transportation Sector Questions

6. How should the state work to ensure the sustainability of its transportation infrastructure with the increased frequency and severity of weather events?

7. How do we achieve environmentally sustainable transportation solutions that ensure a fair and equitable distribution of benefits for everyone?

2016 CT Comprehensive Energy Strategy (CES)

Agenda for Public Scoping

- Background of the CES Proceeding; Objectives for Scoping
- Tentative Schedule for 2016 CES Proceeding
- Organization of the 2016 CES
- Guiding Principles for 2016 CES
- Public Scoping: Key Topics; Initial Data; Research Questions
  - Electricity Sector
  - Buildings & Processes Sector
  - Transportation Sector
- Next Steps

Next Steps

June 14, 2016 comments due for public scoping:

- Written comments may be filed electronically on DEEP's website (http://www.ct.gov/deep/cwp/view.asp?a=4405&q=493990&deepNav_GID=2121) or may be submitted directly to DEEP at DEEP.EnergyBureau@ct.gov on or before **June 14, 2016, by 4:00 p.m. EDT.**

- All materials submitted by stakeholders in this proceeding will be posted on the DEEP website.

- Any questions may be directed to Debra Morrell at (860) 827-2688 and/or via electronic mail at DEEP.EnergyBureau@ct.gov.