BUREAU OF ENERGY AND TECHNOLOGY POLICY

Slides for the morning and afternoon sessions are in separate decks. This is the **morning** deck.

December 15, 2022

Market-Based Decarbonization Programs & Low-Carbon Incentives

Technical Session 8
CT 2022 Comprehensive Energy Strategy

Session is being recorded

Logistics & Housekeeping

- **This session is being recorded**
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- **To enter the queue to provide verbal comment, use Zoom's *raise hand* feature (more details will be provided later)**
- **Use the chat function to ask questions about presentations or procedures.**

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Today's Agenda – Morning

Click on an agenda section heading to jump to the relevant slides

Welcome & Introduction	9:00-9:10 am
Public Comment	9:10-9:30 am
Topic Introduction	9:30-10:00 am
Policy Recommendations Received through Prior CT Processes	10:00-10:35 am
What Other States are Doing	10:35-11:45 am
Q&A	11:45-12:00 pm
----------LUNCH----------	12:00-1:00 pm

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Today's Agenda – Afternoon

Slides for the afternoon session are in a separate deck

What Other States are Doing Continued	1:00-1:55 pm
Q&A	1:55-2:10 pm
Proposals for CT's Path Forward	2:10-3:45 pm
Q&A	3:45-4:00 pm
Public Comment	4:00-4:20 pm
Wrap Up	4:20-4:30 pm

KEEPING THE CONVERSATION GOING

Technical Session	Meeting Date(s)	Deadline for Written Comments
7	Dec. 8, 2022 9 a.m. - 5 p.m. ET	January 6, 2023, at 5:00 p.m. ET
8	Dec. 15, 2022 9 a.m. - 5 p.m. ET (Today)	January 6, 2023, at 5:00 p.m. ET

Written Comment Opportunities

- **After each technical session DEEP will be accepting written comments**
- **Email comments to DEEP.EnergyBureau@ct.gov or submit them via Energy Filings**
- **For additional submission instructions and specific questions for which DEEP is seeking responses, please watch for an upcoming notice**
- **All notices are posted on the CES web page: https://portal.ct.gov/DEEP/Energy/Comprehensive-Energy-Plan/Comprehensive-Energy-Strategy**

We intend to schedule general listening sessions for early next year

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WELCOME & INTRODUCTIONS

Thanks for joining our technical session today!

Comprehensive Energy Strategy Scope & Objectives

- **Scope**: electricity, thermal energy, and fuels for transportation

- **Objectives:**
  - Examine future energy needs in the state and identify opportunities to reduce costs, ensure reliable energy availability, and mitigate public health and environmental impacts of CT's energy use
  - Provide recommendations for legislative and administrative actions to aid in achievement of interrelated environmental, economic, security, and reliability goals

BETP Mission: to manage energy, telecommunication, and broadband policy issues and program deployment with the goal of establishing a clean, economical, equitable, resilient, and reliable energy future for all residents.

DEEP's Approach to the 2022 CES

5 Key Lenses

- **Climate** – meeting greenhouse gas reduction obligations under Global Warming Solutions Act
- **Equity** – energy decisions that produce equitable outcomes
- **Affordability** – energy decisions that produce affordable outcomes
- **Economic development** – workforce development; economic competitiveness
- **Reliability & Resilience** – energy system improvements and load balancing

Key Strategies

- Build on and/or modify findings and recommendations of 2013 and 2018 CESs
- Consider emerging issues not addressed in a prior CES
- Rely on results from recent, major quantitative studies where appropriate rather than duplicate efforts

3 Key Factors

- The carbon intensity of the electric grid
- Need for emission-reduction solutions that facilitate climate change adaptation, resilience, and energy security
- Fuel price volatility

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Tentative CES Development Timeline

- **September 2022** – Technical Sessions 1-3
- **Nov. & Dec. 2022** – Technical Sessions 5-8
- **December 2022 – January 2023** – Drafting & Public Comment Periods for 3 White Papers
    - Building Thermal Decarbonization
    - Active Demand Response
    - Hydrogen
- **Q1 & Q2 of 2023** – CES Drafting, Public Comment Opportunities, & Listening Sessions

Technical Session Topics

1. Hard-to-Decarbonize End Uses
2. Heat Pump Market Barriers & Strategies
3. Building Thermal Decarbonization Support Strategies
4. Building Thermal Decarbonization – Economic Potential & Technology Targets [written comment opportunity only – no live technical session]
5. Electric Demand Response
6. Alternative Fuels
7. Natural Gas Planning & Policies
8. Carbon Pricing & Low-Carbon Incentives

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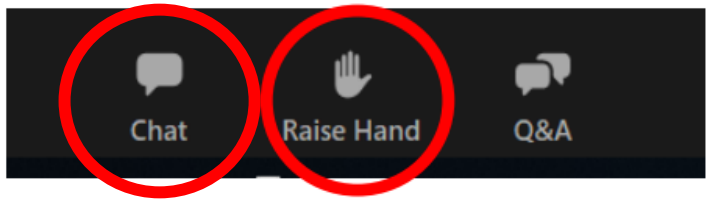
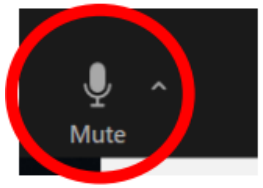
Questions and Comments





Lower left of the screen

At the conclusion of each panel DEEP will hold a brief question and answer period.

If you have a question for a presenter, please drop it into the chat to Jeff Howard. DEEP will pose as many questions as time allows to the speakers. Clarifying questions will be prioritized. Leading questions will not be accepted.

If you would like to make a comment during the public comment periods:

- Please use the “Raise Hand” feature if you would like to speak
- After any interested elected officials have provided their comments, you will be invited to provide your comment in the order the hands were raised
- Please unmute yourself, state your name and affiliation
- Given time limitations, please limit your comment to 2 minutes.
- After your comments, please remember to click the “Mute” button

General Public Comment

BUREAU OF ENERGY AND
TECHNOLOGY POLICY

Topic Introduction

Jeff Howard – CT DEEP – Bureau of Energy & Technology Policy (BETP)

Introduction Slides

Connecticut Context Slides

Click on an agenda section heading to jump to the relevant slides

BUREAU OF ENERGY AND TECHNOLOGY POLICY

Topic introduction – *Market-based decarbonization programs and low-carbon incentives*

Dec. 15, 2022

Jeff Howard, DEEP Energy & Technology Policy

CES Technical Meeting 8

- What are market-based decarbonization programs and low-carbon incentive policies?
- Why consider them?

Definitions

Market-based decarbonization

– Strategies that harness carbon markets to reduce GHG emissions

Low-carbon incentives

– Strategies that reward consumer use of technologies involving minimal or zero carbon emissions

Types

Market-based decarbonization

- Carbon pricing

  - Government assesses fee or price for each ton of emissions
  - Numerous countries, a few U.S. states; fee and scope vary
- Cap-and-trade

  - Government sets emissions limits in a sector, issues allowances; emitters sell/trade allowances
  - *Examples:* RGGI (electricity); California/Quebec (electricity, industry, fuels); national cap/trade programs in China and EU (scope varies)

Low-carbon incentives

- Government or utility financial incentives for:
  - Solar photovoltaic installation
  - Electric vehicle purchase
  - Heat pump installation
  - Etc.

What role do they perform?

Fossil fuels benefit from uneven playing field

1. ‘Externalized’ cost of carbon
2. Disproportionately large subsidies for fossil fuels

Carbon pricing and low-carbon incentives can make playing field less uneven

1. Externalized cost of carbon

- Social and environmental costs of carbon emissions (e.g., impacts of rising sea level) are excluded from market prices
- Has distorted behavior of businesses and consumers for 2+ centuries; fundamental feature of fossil-fuel economy
- U.S. EPA estimate: $190/metric ton CO_2e

CT	$8 billion/year (2018)	3.2% of GDP
U.S.	$992 billion/year (2020)	4.7%
China	$2.3 trillion/year (2021)	12.8%
World	$9.5 quadrillion/year (2019)	10.8%

Far higher than existing carbon prices and low-carbon incentives

2. Disproportionately large subsidies for fossil fuels

IRENA

Using different methodology, IMF estimated fossil fuel subsidies at $5.9 trillion (2020)
IMF

Why carbon pricing and low-carbon incentives?

They can make playing field less uneven by:

- ‘internalizing’ some fossil fuel costs
- reducing net advantage that fossil fuel subsidies provide

Why does this matter in Connecticut?

1. CT is not decarbonizing fast enough to reach our climate goals
2. Decarbonization has important benefits beyond protecting climate

1. CT is not decarbonizing fast enough

GWSA economywide GHG emission reduction required, 2001-2030: 45%

For 2001-2018: 26%

	Proportion of statewide GHG in 2018	Historical emission reduction, 2001-2018	Emission reduction needed, 2018-2030
Electricity	19%	35% ★	0.5X
Residential (*Thermal*)	18%	10%	3.6X faster
Commercial (*Thermal*)	10%	0%	full 45% (3.8%/yr)
Transportation	37%	11%	3.3X faster

2. Decarbonization can provide important benefits beyond protecting climate

Potential co-benefits

- Reduced exposure to fuel price volatility
- Enhanced energy security
- Enhanced public health
- Enhanced ecosystem health
- Disaster avoidance & improved resilience

A final thought

Structure of market-based decarbonization programs and low-carbon incentives is important

Assure that benefits are realized

- Climate goals
- Economic efficiency

Avoid pitfalls

- Protect affordability
- Avoid undermining equity & environmental justice
- Protect innovation

Market-based decarbonization programs and low-carbon incentives in Connecticut

Dec. 15, 2022

Jeff Howard, DEEP Energy & Technology Policy

CES Technical Meeting 8

- Electricity, thermal, transportation – account for 90% of GHG emissions
- Are decarbonization incentives in these sectors sufficient?

Electricity

- Zero-carbon grid by 2040 (PA 22-5) link

- Renewable Portfolio Standard link
- Regional Greenhouse Gas Initiative link
- Shared Clean Energy Facilities program link
- Residential Renewable Energy Solutions Program link
- Clean energy procurements link
- Demand-response incentives link
- Federal incentives (IRA link, IIJA link)

Thermal

- Energize CT link, WAP link, LIHEAP link, incentives for efficiency upgrades or heat pumps
- Biodiesel blending (PA 21-181) link
- Financing programs through Energize CT link
- Smart-E financing through CT Green Bank link
- Renewable Fuel Standard support for biodiesel link
- Federal incentives (IRA link, IIJA link)

Transportation

- CT Hydrogen & Electric Automobile Purchase Rebate link
- Electric Vehicle Charging Program link
- Renewable Fuel Standard support for ethanol and biodiesel link
- National EV Infrastructure program link

CT is not decarbonizing fast enough

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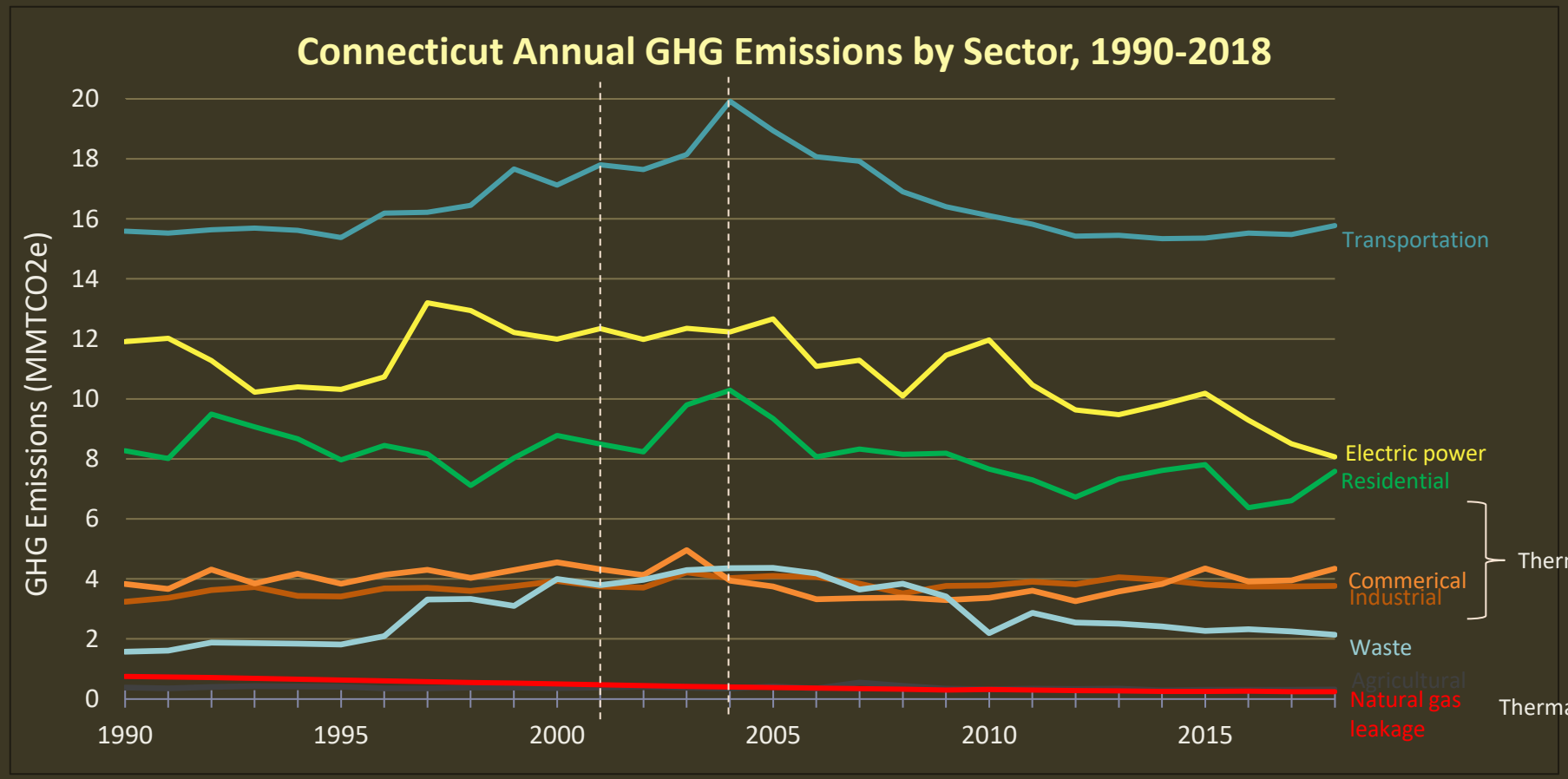
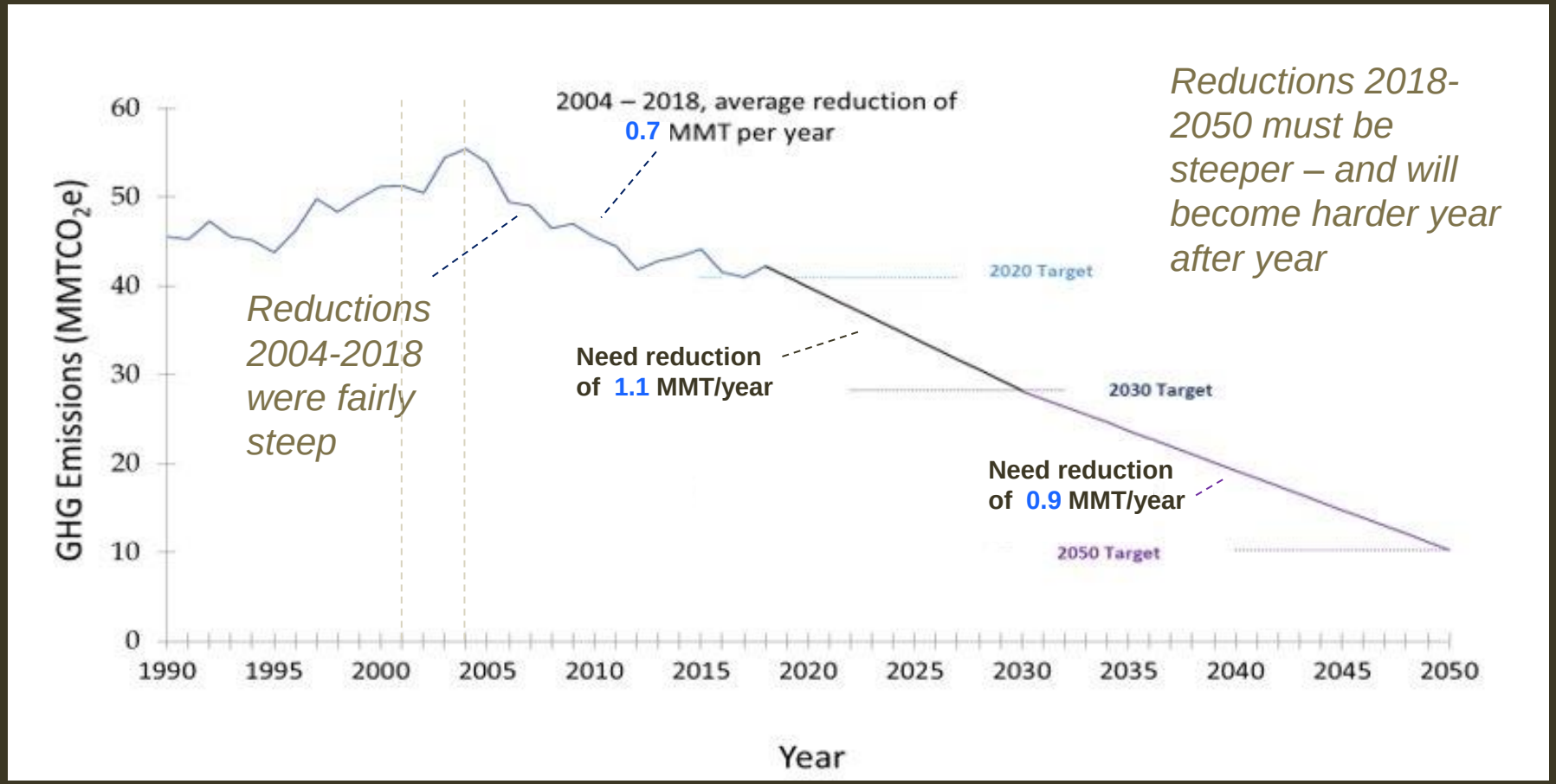

Connecticut Annual GHG Emissions by Sector, 1990-2018
GHG Emissions (MMTCO2e)
20
18
16
14
12
10
8
6
4
2
0
1990
1995
2000
2005
2010
2015
Transportation
Electric power
Residential
Commerical
Industrial
Thermal
Waste
Agricultural
Natural gas leakage
Thermal


2004 – 2018, average reduction of
0.7 MMT per year
Reductions 2018-2050 must be steeper – and will become harder year after year
Reductions 2004-2018 were fairly steep
2020 Target
Need reduction of 1.1 MMT/year
2030 Target
Need reduction of 0.9 MMT/year
2050 Target
GHG Emissions (MMTCO2e)
60
50
40
30
20
10
0
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
Year

Conclusions

- Except in electric power sector, reductions in major sectors have been modest, at best – reductions in thermal and transportation emissions need to accelerate dramatically
- Numerous low-carbon incentives and market-based decarbonization initiatives are in place, and others are emerging
- Key question: What role can *expanded/stronger* initiatives of this kind play in *accelerating* reductions?

Jeff Howard
Environmental Analyst, Bureau of Energy & Technology Policy
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Policy Recommendations Received through Prior CT Stakeholder Processes

Alanis Allen – CT DEEP – Office of Climate Planning

George Lawrence – CT Energy Efficiency Board

Jeff Howard – CT DEEP – Bureau of Energy & Technology Policy (BETP)

(speaker order may vary)

Click on an agenda section heading to jump to the relevant slides

BUREAU OF ENERGY AND TECHNOLOGY POLICY

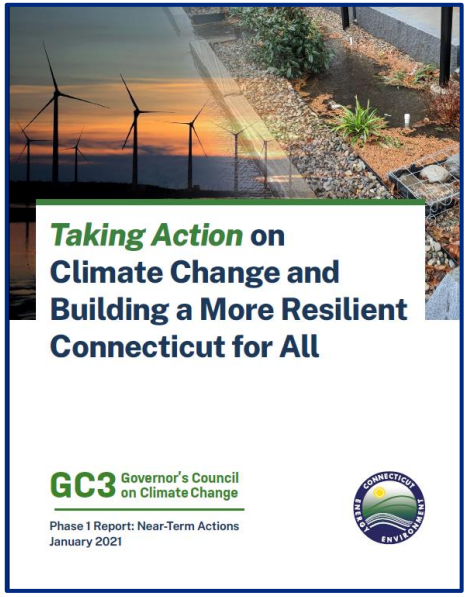
CT DEEP – Office of Climate Planning

Market-based Decarbonization Recommendations from the Governor's Council on Climate Change

Alanis Allen
Research Analyst
Office of Climate Planning
Connecticut DEEP

Brief history of the Governor's Council on Climate Change (GC3)

- Executive Order 3: "the Council shall monitor and report on the state's progress on the implementation of carbon mitigation strategies, as well as on the development and implementation of adaptation strategies to assess and prepare for the impacts of climate change in areas such as infrastructure, agriculture, natural resources and public health."
- The GC3 has several working groups including the Mitigation Strategies
- In 2020, each working group created a final report of their recommendations.
- The GC3 approved the final 61 recommendations that made it to the report, *Taking Action on Climate Change and Building a More Resilient Connecticut for All*



GC3 Recommendations: Mitigation Strategies

Buildings Sector
9a. **Develop sustainable funding mechanisms to incentivize replacement of fossil fuel space and water heating with efficient renewable thermal technologies (RTT).** Rebate programs are available through the Energy Efficiency Fund paid for by fees on natural gas and electric utility bills and Regional Greenhouse Gas Initiative (RGGI) funds. Further enhancements include requiring delivered-fuels companies to contribute to the Energy Efficiency Fund. This requirement would reduce the cross-subsidization of delivered fossil fuels by electric ratepayers and make more money available for RTT deployment.

Enhancement from Mitigation Strategies Working Group Report
Support municipal-scale RTT investment through Community Choice Aggregation. Authorizing municipalities to adopt CCA would provide a financial and administrative platform for systematic local investment in deployment of HPs and other RTTs via group purchase.

Community Choice Aggregation: A program through which municipalities (or groups of municipalities) procure electricity on behalf of constituents in order to lower energy costs or secure less carbon-intensive energy. CCA communities continue to receive electricity distribution via the local utility. Connecticut has not authorized CCA.

GC3 Recommendations: Mitigation Strategies

Buildings Sector
9b. **Incentivize installation of renewable thermal technologies in new construction.** Incentives for RTTs for new residential, commercial, and industrial buildings are available through the Residential New Construction program and Energy Conscious Blueprint program. Program updates will be rolled out with the next code adoption to drive the new-construction marketplace toward zero-energy buildings with low operational Energy Use Intensity ratings. New program offerings will support integrated design and whole-building energy modeling at the feasibility phase and will offer incentives to customers who incorporate energy-reduction strategies through post occupancy.

Progress Update
EO21-3 Sec.3 requires DEEP and DAS to develop a plan to retrofit existing state buildings to be operated without carbon emitting fuels and to develop a plan to achieve zero-GHG emissions for all new construction and major renovations funded by the state or in facilities owned/operated by the Executive Branch

GC3 Recommendations: Mitigation Strategies

Electric Sector
12b. **Ensure a transparent and predictable compensation framework to maintain at least the historical annual average 40-90 megawatts of residential behind-the-meter renewable energy resources.** As retail electricity rates continue to rise, Connecticut must develop a transparent and consistent compensation structure for behind-the-meter renewable-energy generation to enable future renewable deployment. The compensation structure implemented should be consistent and easy to understand, and it should ensure a reasonable rate of return for customers and project developers, incentivizing deployment of distributed-generation sources to facilitate grid decarbonization.

Progress Update
The Residential Renewable Energy Solutions (RRES) program offers residential customers living in a 1-4 family unity the opportunity to install renewable energy on their home and sell the energy and renewable energy certificates (RECs) at a 20-year fixed price. This program is the successor for the Residential Solar Incentive Program (RSIP) and residential net-metering. The online portal went live in January, 2022 and applications are being accepted on a rolling basis. There is no MW cap.

GC3 Recommendations: Mitigation Strategies

Non-Energy Sector
15c. **A disposal tax based on an estimate of the greenhouse gas (GHG) emissions of the final disposal process** to fund incentives for a more sustainable waste management system.

GC3 Recommendations: Mitigation Strategies

Transportation Sector
20c. Remove the legislative barrier to exploration of a mileage-based user fee. In setting a price for carbon in the transportation sector, a MBUF and an emissions trading system (ETS) such as the Transportation and Climate Initiative are not mutually exclusive. A MBUF is paid directly by transportation infrastructure users, and the revenue it produces exclusively supports infrastructure maintenance and improvement, while TCI sets a declining cap on carbon emission from burning fossil fuels in cars and trucks. TCI requires large suppliers of gasoline and diesel fuel to hold allowances for the pollution produced from combustion of the fuel they sell to consumers. In this case, there is passthrough and fossil fuel users will see an increase in gasoline and diesel prices while fuel suppliers absorb part of the cost increase. (From the Mitigation Strategies WG Report)

GC3 Recommendations: Mitigation Strategies

Transportation Sector
21a. **Implement the multi-state cap-and-invest Transportation and Climate Initiative program (TCI-P) that will set a limit on transportation sector emissions and reinvest program proceeds in measures that reduce emissions**; provide benefits to citizens, especially low- and moderate-income communities; protect existing transportation funding; generate sufficient additional funding to support transportation infrastructure and operation; and mitigate costs to consumers.

GC3 Recommendations: Natural and Working Lands

Agriculture Sub-group
42e. **Establish a process in which the State may direct the electric distribution companies to enter into long-term agreements to purchase power or renewable natural gas from anaerobic digestion facilities**, including policies and incentives to enable on-farm anaerobic digesters.

Progress Update
DEEP already has authority to run an RFP for an Anaerobic Digester Power Purchase Agreement, and Anaerobic Digester facilities are eligible for the Non-Residential Renewable Energy Solutions program.

CT Energy Efficiency Board

December 15, 2022

Connecticut Conservation and Load Management

Energize CT

Energy Efficiency Programs

energize CONNECTICUT CT℠

Current C&LM Electric Goals Help Reduce GHG Emissions

- The Energize CT Programs have MWh and MW goals to save energy and reduce electric demand
- Saving a MWh in 2020 saved 591 pounds CO2 per MWh on average, and 742 pounds CO2 per peak MWh
- The electric grid is getting cleaner with the installation of more renewable energy

2020 ISO New England
Average Native Generation Emission Rates (lbs/MWh)

State	NO_x	SO_2	CO_2
Connecticut	0.17	0.02	591
Maine	0.31	0.09	529
Massachusetts	0.55	0.09	958
New Hampshire	0.13	0.03	386
Rhode Island	0.13	0.01	879
Vermont	0.33	0.02	609
New England	0.25	0.04	654

2019 and 2020 Time-Weighted and Load-Weighted LMU Marginal Emission Rates (lbs/MWh)

	LMU Marginal Emission Rates					
	Time-Weighted			Load-Weighted		
	2019 Annual Rate	2020 Annual Rate	Percent Change 2019 to 2020	2019 Annual Rate	2020 Annual Rate	Percent Change 2019 to 2020
	(lbs/MWh)	(lbs/MWh)	(%)	(lbs/MWh)	(lbs/MWh)	(%)
All LMUs						
NO_x	0.10	0.11	10.0	0.11	0.10	-9.1
SO_2	0.02	0.02	0.0	0.03	0.02	-33.3
CO_2	648	706	9.0	719	742	3.2
Emitting LMUs						
NO_x	0.15	0.16	6.7	0.15	0.13	-13.3
SO_2	0.04	0.03	-25.0	0.04	0.03	-25.0
CO_2	970	971	0.1	943	904	-4.1

https://www.iso-ne.com/static-assets/documents/2022/05/2020_air_emissions_report.pdf

Current C&LM Fuel Goals Help Reduce GHG Emissions

- The Energize CT Programs have goals for natural gas (expressed in 100 Cubic Feet units (CCF)) and oil and propane (expressed in gallons):
  - Saving a CCF of Natural Gas saves 12.1 pounds of CO2
  - Saving a gallon of oil saves 22.45 pounds of CO2, and a gallon of propane is worth 12.68 pounds
- All electric and fuels savings are also converted to million British Thermal Units (MMBTU) and tracked against a 1.6 million MMBTU legislative goal

Carbon Dioxide Emissions Coefficients by Fuel

Carbon Dioxide (CO_2) Factors:	Pounds CO_2 Per Unit of Volume or Mass
For homes and businesses	
Propane	12.68 gallon
Diesel and Home Heating Fuel (Distillate Fuel Oil)	22.45 gallon
Kerosene	21.78 gallon
Coal (All types)	3,876.61 short ton
Natural Gas	120.96 thousand cubic feet

https://www.eia.gov/environment/emissions/co2_vol_mass.php

Recent Cross Sector Program Decarbonization Actions

1. New CT Cost effectiveness test includes avoided greenhouse gas emissions
2. Energize CT will provide virtual no-cost heat pump consultations
3. Develop and manage a heat pump installer network and provide contractor heat pump trainings
4. Fuel baselines have changed to better support decarbonization, fuel neutrality, and reality
5. Re-evaluated heat pump and controls incentives as part of DEEP COA #11
6. Develop and manage an insulation contractor network

Eliminated incentives when replacing condensing gas furnaces and boilers

Transitioned the Residential New Construction Program to “All-Electric” starting July 2023

Increased focus and funding on weatherization through Home Energy Solutions and Home Energy Solutions – Income Eligible

Increased focus and funding on heat pumps

Residential Program Decarbonization Actions

C&I Program Decarbonization Actions

1. Oil and propane savings can be counted for cost effectiveness purposes
2. Increased technical support and incentives for C&I weatherization
3. Increased technical support and incentives for C&I heat pumps
4. Zero Net Energy/Ready or Passive House pathway for commercial new construction
5. IECC transition from 2015 to 2021 and C1931 Industry Standard Practice baseline study increase baselines for boilers and furnaces
6. Commercial kitchen refrig./freezer recycling, support for induction cooktops and other electric Energy Star equipment

Looking Forward

1. Evaluation study underway now to look at current goals and performance incentives, program design, efficiency program budgets, what other states are doing, and alignment with state GHG goals and the Comprehensive Energy Strategy.

2. Are the current goals the correct goals? Or should there be a change to a greenhouse gas goal or a MMBTu goal? There are tradeoffs, considerations, and potential unintended consequences to change. Need to consider equity.

3. What is allowed or being limited under the current statute that governs the Energize CT programs? What is the Impact of the Inflation Reduction Act?

December 15, 2022

Thank you

George Lawrence

EEB Technical Consultant

energize CONNECTICUT

CT DEEP - BETP

DEEP consideration of thermal portfolio standards

Dec. 15, 2022

Jeff Howard, DEEP Energy & Technology Policy

CES Technical Meeting 8

- Terminology
- How a basic T-RPS program works
- History of DEEP attention to T-RPS
- Pros and cons of T-RPS programs
- Issues to be assessed in CES

Terminology

RPS Renewable portfolio standard

T-RPS Thermal renewable portfolio standard
aka T-REC = Thermal renewable energy credit system

RTT Renewable thermal technology – e.g., heat pump, boiler burning biodiesel, woodstove

REC Renewable Energy Credit

What is T-RPS?

CT Renewable Portfolio Standard

- Requires escalating proportion of renewable energy for *electricity generation* (29% in 2020; 48% in 2030)
- A key means of achieving zero-carbon electricity by 2040
- Incorporates only one form of *thermal energy*: use of waste heat qualifies for Class III credits (max. 4% in 2030)

Thermal RPS

- None in Connecticut at present
- Would provide support for broader range of low-carbon thermal energy

T-RPS basics

At least 14 states (e.g., ME, NH, VT, MA) have some form of T-RPS

- Usually parallel or attached to traditional RPS
- Provide ongoing incentives for use of RTTs

Basic design:

- State designates RTTs eligible to produce RECs
- Customer produces BTUs using these RTTs, acquires RECs
- RECs are aggregated by third parties and tracked by regional oversight body
- Aggregators sell RECs and compensate customer

History

Yale study recommends CT develop a T-RPS link	*March 2017*
Legislature directs DEEP to 'consider creation of portfolio standard for thermal energy' link	*June 2018*
Briefing document on New England T-RPS programs link	*Nov. 2019*
Technical meeting on thermal RPS programs notice slides	*Dec. 2019*
Technical meeting on biodiesel as thermal resource notice slides	*July 2020*
(Legislature directs that CES consider lifecycle GHG benefits of biofuels – and mandates biodiesel blending link)	*(July 2021)*
Integrated Resources Plan assesses biodiesel as low-carbon resource and T-RPS as mechanism for incentivizing its use link (see Part III)	*Oct. 2021*
(Mandatory biodiesel blending commences)	*(July 2022)*

Weighing the proposition

Pros	*Cons*
Institutionalizes recognition of importance of renewable thermal energy	Administration can be complex
Provides ongoing, rather than one-time, support for RTT deployment	If incorporated in an existing RPS, can muddy its mission and the market signals it sends
Offers limited but significant step to level the playing field (fossil fuels highly subsidized)	Most accurate basis is metering, which is costly
Borrows model of – and even piggybacks on – successful RPS programs	

Issues to be addressed in CES

Is T-RPS needed in Connecticut to supplement existing decarbonization incentive/support programs?

If so:

- What are best design features for state T-RPS programs?
- Which RTTs should it cover? Emphasis on non-combustion?
- Build it into existing RPS, or make it free-standing?
- Which customer base(s) should provide financial support?
- Should RECs be tradeable?
- Restrictions on biofuel feedstocks?
- Is legislation required?

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What Other States are Doing

Samantha Meserve – Massachusetts Department of Energy Resources (DOER)

Richard Cowart – Regulatory Assistance Project (RAP)

Erin Cosgrove – Northeast Energy Efficiency Partnerships (NEEP)

Adam Ruder – New York State Research & Development Authority (NYSERDA)

Olivia Griot – Synapse Energy Economics

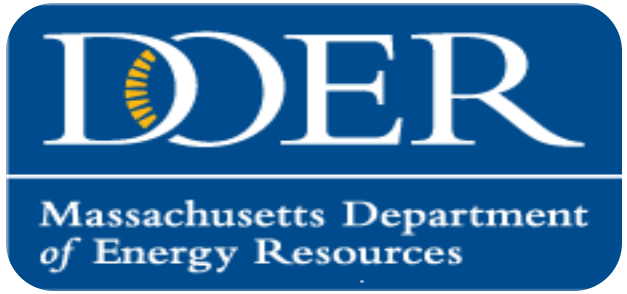
(speaker order may vary)

Click on an agenda section heading to jump to the relevant slides

BUREAU OF ENERGY AND TECHNOLOGY POLICY

Massachusetts Department of Energy Resources (MA DOER)

Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth



COMMONWEALTH OF MASSACHUSETTS
Charles D. Baker, Governor
Karyn E. Polito, Lt. Governor
Matthew A. Beaton, Secretary
Judith Judson, Commissioner

CT Comprehensive Energy Strategy Technical Session:

Market-based decarbonization programs and low-carbon incentives

December 15, 2022

Alternative Energy Portfolio Standard

Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

DOER
Massachusetts Department of Energy Resources

What is a Portfolio Standard?

- State program requiring a certain percentage of the in-state load served by Load Serving Entities (LSEs) come from renewable energy
- LSEs meet their yearly obligations by procuring Renewable Energy Certificates (RECs)
- One REC = 1 MWh or equivalent
- Obligation typically expressed as percent of total electric load

Example:

Utility serves 1,000,000 MWh of load in 2020 and has an obligation to procure 10% of that through the purchase of RECs

1,000,000 MWh x 0.10 = 100,000 MWh (number of RECs they must procure)

Market Pricing

- Market driven
  - Price is driven by supply and demand
- State usually sets two variables:
  - Minimum Standard (demand)
  - Alternative Compliance Payment (ACP) Rate (price ceiling)
- Minimum Standard refers to yearly percentage obligations placed upon compliance entities
- ACP rate is the price LSEs must pay for every MWh they are short of meeting their obligation

Alternative Energy Portfolio Standard (APS) Background

- The APS was established as of January 1, 2009, under the Green Communities Act of 2008
- Supports alternative energy technologies that increase energy efficiency and reduce the need for conventional fossil fuel-based power generation
- The following technologies are currently eligible:
  - Combined Heat and Power
  - Flywheel Storage
  - Gasification with Carbon Capture and Permanent Sequestration
  - Paper Derived Fuel
  - Efficient Steam Technology
- Eligible technologies are able to generate one Alternative Energy Certificate (AEC) for each MWh of electricity or 3,412,000 Btus of Useful Thermal Energy produced
- Each retail electricity supplier in MA must demonstrate that a percentage of the electricity they sell to customers is met by these eligible technologies via the purchase of AECs or the payment of Alternative Compliance Payments (ACPs) each year.
- The 2022 requirement is 5.5% of retail load served and is set to increase 0.25% each year.
- The 2017 ACP rate is $24.74/MWh and changes each year with the Consumer Price Index (CPI)
- Current market value of AECs is approximately $5/MWh

2014 and 2016 Statutory Changes

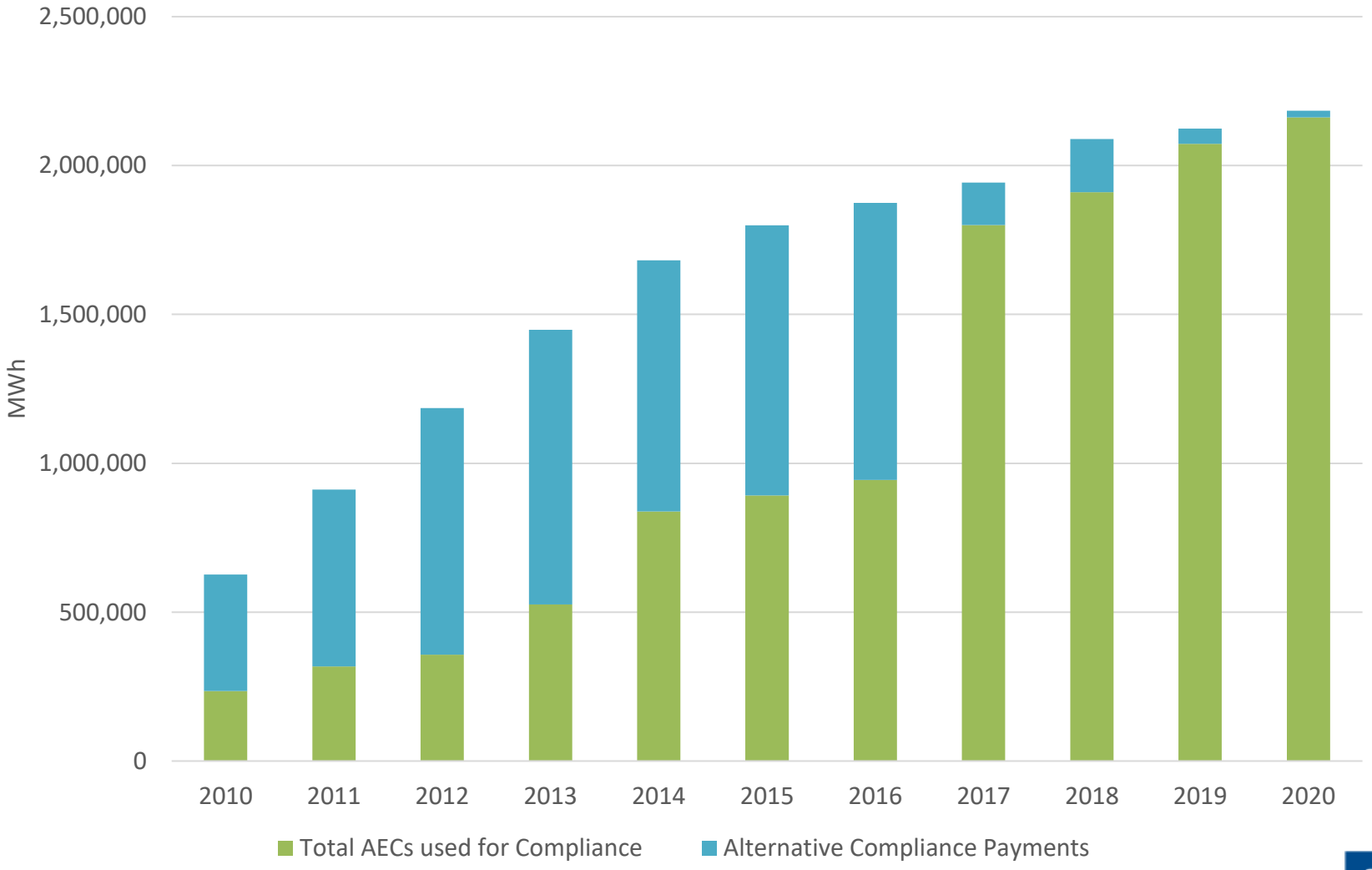
Chapter 251 of the Acts of 2014 requires DOER to make changes to the existing APS regulations, including:

- Adding the following generation and fuel sources as eligible renewable thermal technologies:
  - Ground Source Heat Pumps (GSHP) and Air Source Heat Pumps (ASHP)
  - Solar Hot Water (SHW) and Solar Hot Air
  - Biomass, Biogas, and Biofuels
- Remove the following technologies as eligible:
  - Gasification with Carbon Capture and Permanent Sequestration
  - Paper Derived Fuel

Chapter 188 of the Acts of 2016 further requires DOER to make changes to the APS regulations, including:

- Adding the following generation and fuel sources as eligible technologies:
  - Fuel Cells
  - Waste-to-Energy Thermal

APS Compliance



Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

DOER
Massachusetts Department of Energy Resources

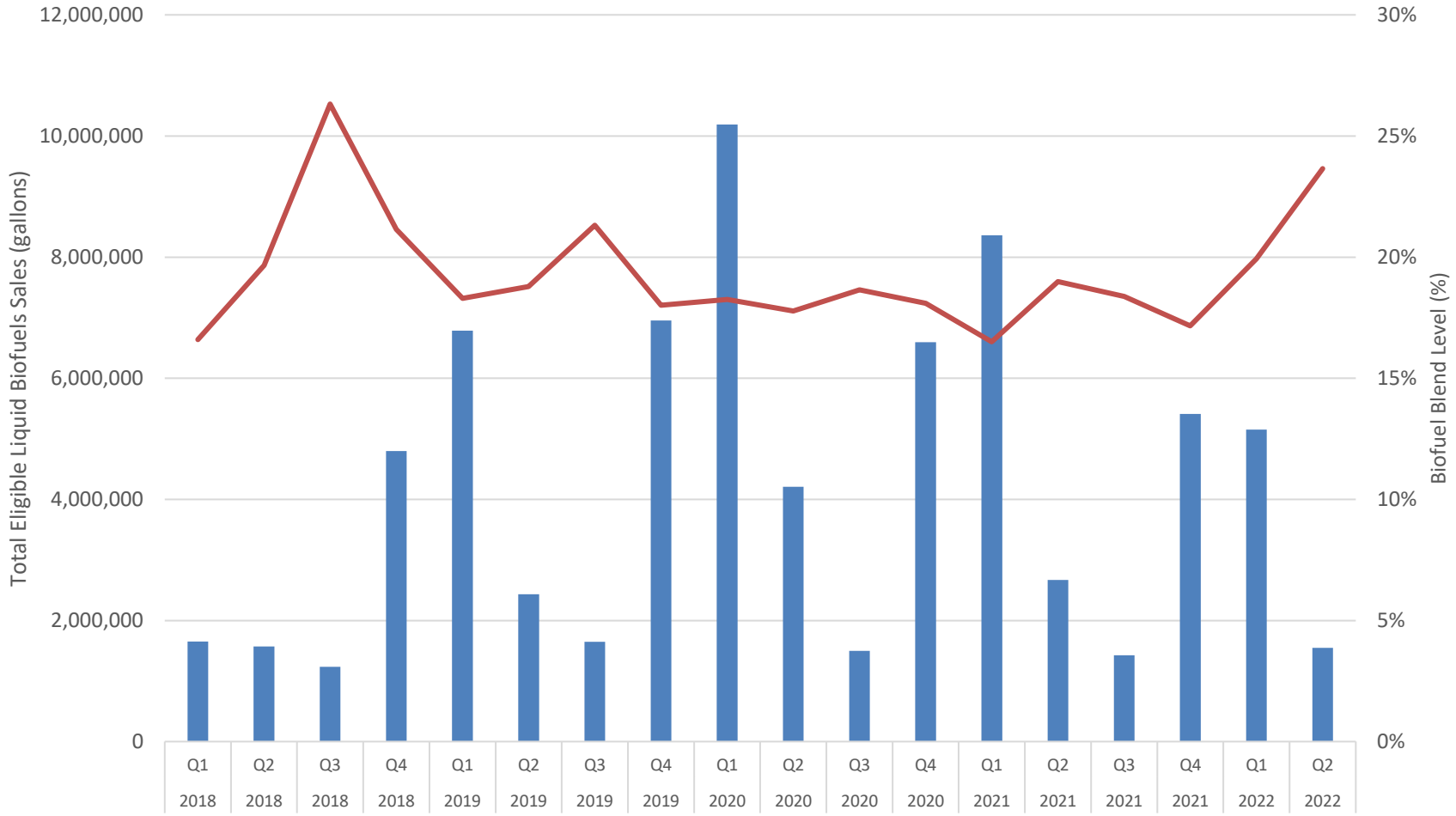
Program Statistics – Renewable Thermal

Project Type	Number of Projects	Sum of Size Non-Solar (kBtu/hr)	Sum of Size Solar (sq ft)
Air Source Heat Pump	3,022	85,510	N/A
Ground Source Heat Pump	506	39,216	N/A
Solar Thermal Evacuated Tube Collector	119	N/A	28,494
Solar Thermal Flat Plate Collector	669	N/A	70,975
Wood Chips Biomass	13	6,769	N/A
Wood Pellet Biomass	83	13,729	N/A
Total	**4,445**	**191,151**	**99,469**

Program Statistics – CHP, Fuel Cells, WTE

Project Type	Number of Projects	Capacity (MWh)
Digester Gas/CHP	2	0.42
Flywheel Storage	2	3.00
Natural & Digester Gas/CHP	2	2.30
Natural Gas/CHP	102	510.97
Natural Gas/Fuel Cell	19	8.65
Waste-to-Thermal Energy	1	0.86
Woody Biomass/CHP	2	0.71
Grand Total	**130**	**526.91**

Program Statistics – Liquid Biofuels



Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

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Commission on Clean Heat

MA Commission on Clean Heat

- The Commission was created via Executive Order 596 in Sept. 2021 and included 22 members representing a diverse range of perspectives and backgrounds from the fields of affordable housing, EE building design, healthcare, environmental advocacy, regional planning, heating systems & technology, real estate, and heating fuel distribution.
- Supported by the Interagency Building Decarbonization Task Force, made up of representatives from EEA, HED, DOER, DEP, and MassCEC, as well as facilitators from the Consensus Building Institute and the Cadmus Group.
- There were 19 full Commission meetings, as well as several smaller group meetings, held between January- November 2022.
- The final report was issued on Nov. 30th, with 21 Commissioners consenting and 1 Commissioner not consenting.

Phases of Work

The Commission focused its work in two Phases-

- Phase 1 was to provide preliminary recommendations for the 2025/2030 CECP, which was done mainly through work groups focused on:
  - Institutions and Financing
  - Public Perception & Community Engagement
  - Technology and Workforce Development
  - Regulatory and Policy Frameworks

- Phase 2 was focused on more in-depth research or deliberation on certain topics through work groups and then full group consensus building. The work group topics included:
  - Design of a Clean Heat Standard
  - Design of a Building Decarbonization Clearinghouse
  - Design of a Climate Bank and strategies for advancing decarbonization in affordable housing
  - Joint electric-gas utility planning, incentive program design, workforce development and consumer outreach
  - Cross-cutting strategies to focus on equity

Final Report Recommendations

The final report recommendations were presented in four sections:

1. Context (Net Zero Future and Constraints and Contingencies)
2. Cross-Cutting Recommendations
3. Recommendations for Regulatory Frameworks for Long-Term Greenhouse Gas Emission Reductions
4. Recommendations for Accelerating the Deployment of Energy Efficiency and Clean Heating Technology.

Cross-Cutting Recommendations

- **Resourcing the Transition:** Additional programs, resources, and reforms, including reconstituting Mass Save under a new Building Decarbonization Clearinghouse, will be needed to support the market transformation that is required for meeting building sector sublimits in as cost-efficient and equitable a manner as possible.

- **Equity:** The Commission recommends the Commonwealth adopt a set of core principles and practices to inform the design of all building decarbonization program and policy initiatives, including robust community engagement and representation in decision-making, focus on implementation and outcomes, deeply embed equity within program design, and utility equity-informed program approaches.

- **Institutional Coordination and Alignment:** For the transition to a decarbonized buildings sector to move at the pace and scale necessary for achieving the building sector sublimits, the Commonwealth will need to improve coordination among the actors essential to achieving building emissions reductions and increase the efficiency and impact of its programs and investments.

Recommendations for Regulatory Frameworks for Long-Term GHG Emissions Reductions

- Implementation of a **Clean Heat Standard** as a regulatory approach to meet the sublimits for the building sector, focusing on electrification and energy efficiency measures.
- **Coordinated joint energy system planning** across Massachusetts' gas and electric utilities and municipal gas and electric companies, and in conjunction with key stakeholders and communities, to ease the transition from gas to electric heating by identifying geographic priorities for investment in and/or strategic retirement of energy infrastructure.
- Development of an **analysis and reporting structure for fossil fuel equipment metrics**, as well as conducting an analysis of the design of a schedule for phasing out new fossil fuel heating systems in the Commonwealth.
- Evaluation of opportunities for addressing operating cost barriers to the adoption of clean heating technologies, including **programs or credits to help defray costs from electrification**, as well as evaluation of cost-reflective rate structures to encourage conservation and reduce operating costs of electric heating systems.

Recommendations for Accelerating Deployment of EE and Clean Heating Technologies

- Development of a **Building Decarbonization Clearinghouse** to serve as a central point of contact and technical assistance provider for customers for all clean energy solutions- including weatherization, heat pumps, energy efficiency measures, along with solar, storage, and EV charging.
- Establishing **climate finance mechanisms** through a Climate Bank to de-risk and mobilize private sector investments for buildings pursuing deep decarbonization measures.
- Accelerating strategies for **decarbonizing the affordable housing** sector in Massachusetts through convening key stakeholders, including representatives from multiple state agencies.
- Expansion of **workforce development programming** to address existing gaps in our decarbonization workforce as well as conduct research, develop best practice guidance, and set standards to fill knowledge gaps with respect to decarbonization of the building sector in Massachusetts.

Recommendations for Accelerating Deployment of EE and Clean Heating Technologies (Cont.)

- Conducting a **comprehensive public outreach and awareness campaign** and implementing community-level engagement strategies to educate and build the necessary momentum for building electrification across the Commonwealth.

- **Expansion of the Green Communities and Leading by Example programs** to effectively utilize state, municipal and institutional building stock to showcase the benefits of decarbonization measures.

- Development of a **statewide building benchmarking and labeling program** to increase transparency on building emissions profiles and encourage building retrofits that improve the climate, health, and economic outcomes across Massachusetts' building stock.

Clean Heat Standard

- Obligated Parties
  - Suppliers of energy to building heating systems, including **utilities, wholesale liquid fuel and propane suppliers, and retailers** as necessary to ensure all fuel delivered to Massachusetts is covered under the standard.
- Credit Creation
  - Available for strategies that reduce GHG emissions, with a strong preference towards pursuing electrification.
- Other Considerations
  - Interactions with other programs
  - Equity
  - Stakeholder engagement

Links and Contact Information

Alternative Energy Portfolio Standard

Massachusetts Commission on Clean Heat

Commission on Clean Heat Final Report

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Regulatory Assistance Project (RAP)

New Tools for Thermal Savings:

Vermont's Clean Heat Standard

Richard Cowart, Principal

Connecticut Comprehensive Energy Strategy

December 15, 2022

Richard Cowart, Principal
rcowart@raponline.org

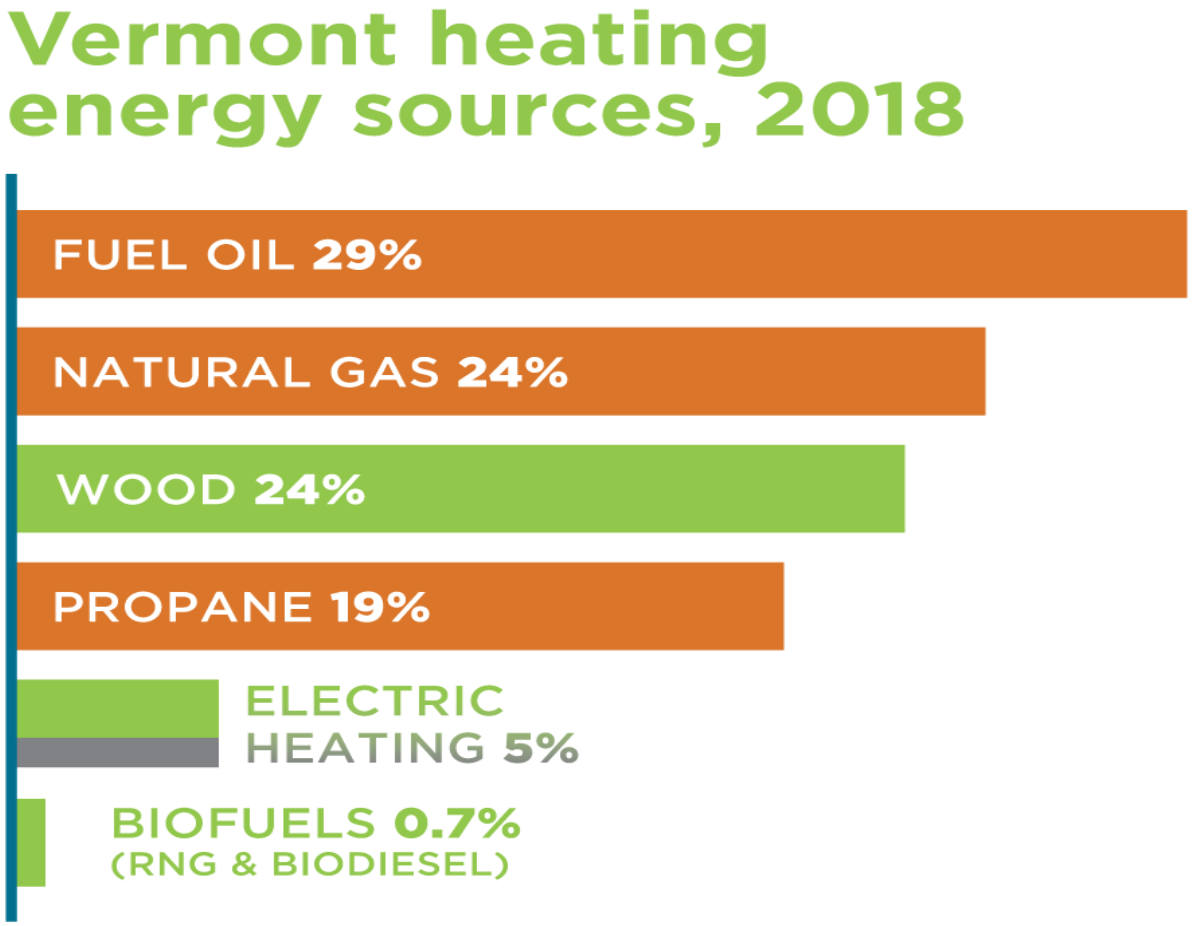
The Regulatory Assistance Project (RAP)®

Fossil Heat May Be Our Toughest Climate Challenge

1. 34% of VT's climate emissions
   - Mostly heating, but also hot water, industrial processes, other uses
2. Large reductions are required - 40% by 2030, 80% by 2050 to meet climate goals, legal mandates
3. Equity focus -Lower income HH have higher energy burdens, less efficient housing and expensive heating sources
4. Housing stock is old, turnover rate is slow
5. Solutions require "kitchen table" decisions

Vermont heat is
72% fossil
24% gas

US average:
58% fossil
49% gas



Source: EIA, 2020; Vermont Department of Public Service, 2020; Efficiency Vermont, 2020; Vermont Agency of Natural Resources, 2020

ENERGY ACTION NETWORK

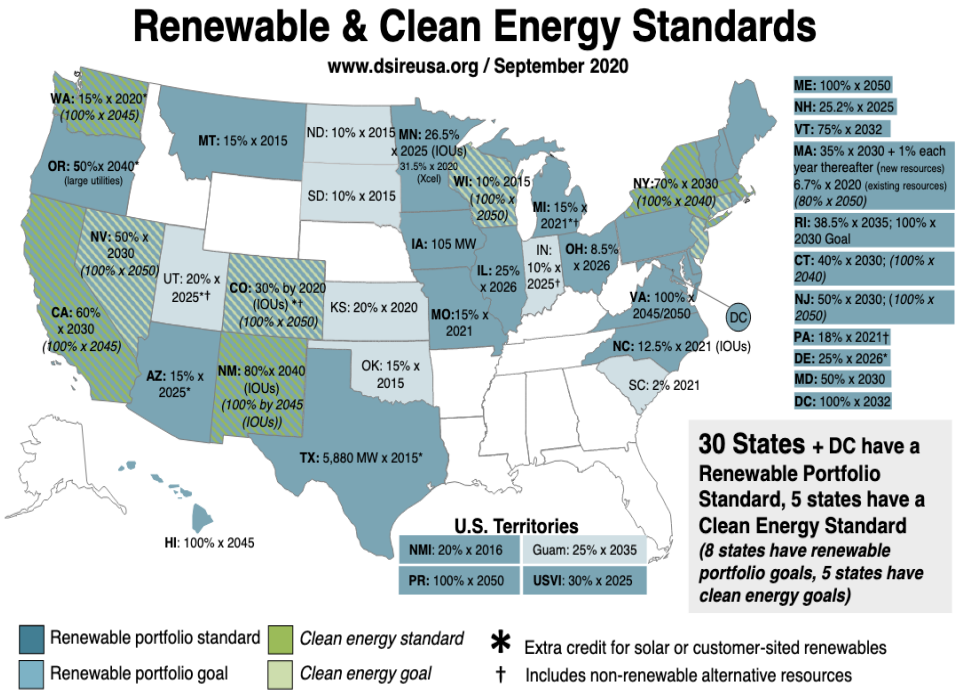
Basic Concept of a Clean Heat Standard (CHS)

*The CHS is a **performance standard**, requiring heat providers to deliver a gradually-increasing percentage of low-emission heating services to customers.*

- Similar to the renewable portfolio standard
  - Increasing annual requirements pegged to GHG goals
  - Measured by delivery at the customer level
- Clean heat choices: Weatherization, electric heat pumps, low-emission fuels
- Obligated parties can deliver cleaner fuels, help convert heat systems, or purchase credits from others

Energy Performance Standards

- 30 states have renewable portfolio standards
- 25 states have EE performance standards
- Low-carbon fuel standards (transportation only) in CA, WA, OR
- Clean Heat Standard in the Vermont Climate Plan
- CO Clean Heat Plan (pipeline gas utilities only)



Vermont Progress

- 2019 - VT Global Warming Solutions Act
- 2021 – VT Climate Council includes CHS in the Climate Action Plan
- 2022 – Legislature passes CHS bill (H.715) by wide margins in both houses
- Governor vetoes; override fails by 1 vote
- Climate Council study: CHS saves $ Billions
- 2023 Session – Affordable Heat bill quite likely, with CHS as the main focus

Architecture of a CHS

1. What is the obligation?
2. Who are the obligated parties?
3. Obligation pathway – how fast, how far in total?
4. How to promote equity?
5. What actions or fuels earn credits?
6. Are certain heat choices excluded or promoted?
7. Regulation & administration

Vermont CHS Design -- Selected Elements

Nature of the Obligation

- Focus: reducing **GHG emissions** in the thermal sector to meet state climate mandates
- **VT Obligated parties: all fossil heat providers**
  - Vermont Gas (utility) and delivered fuel dealers
  - In proportion to their fossil fuel sales
- Folds in thermal obligation on electric utilities too
- Credits are earned by **actions at VT customer locations that reduce emissions**, measured in tons of CO2e

What Actions Earn Credits?

Many possibilities:

- Weatherization
- Heat pumps and heat pump water heaters
- Certain biofuels and renewable gases
- Low-carbon district heating
- Solar thermal and advanced wood heating
- Renewable hydrogen

- Customer choice is key to acceptance
- Key feature: Anyone can earn credits

More on credits:

- CHS requires delivery of clean heat solutions to **low- and moderate-income households**
- Credits measured on a **net lifecycle basis** and only **if delivered** in state. (i.e., no offsets).
  - GREET and other models provide good data on fuel pathway emission rates
- Important to support installed measures (Wx, HPs)
- **Guardrails** included on biofuels, RNG, and woody biomass

Administration

- CHS will be regulated by the Vermont Public Utilities Commission
- Technical Advisory Group (TAG) will advise on credit values and lifecycle rates - similar to the TAG used for energy efficiency measures
- Equity Advisory Group to help insure affordability and broad inclusion in CHS benefits

Why a Clean Heat Standard ?

- **We need a policy driver to deliver large GHG savings**
  - Incentives alone - are not enough
  - Public funds and taxes – not reliable enough
  - Businesses need a predictable path
- **CHS supports diverse heating solutions**
  - Wx and efficiency count but just 25% of the answer
  - Heat pumps are key but harder in Vermont
  - RNG, biofuels, advanced wood heat, geothermal options
- **Customer choice is essential**
- **Performance standards work**

Resources

- Vermont General Assembly, H.715 (2022), “An act relating to the Clean Heat Standard” as passed by House and Senate, found at *https://legislature.vermont.gov/* *
- Richard Cowart and Chris Neme, “The Vermont Clean Heat Standard” (December 2021), a Vermont Energy Action Network whitepaper, found at *https://www.eanvt.org/chs-whitepaper/*
- Regulatory Assistance Project, “A Clean Heat Standard for Massachusetts,” Appendix B to the *Massachusetts Clean Energy and Climate Plan for 2025 and 2030. (June 2022)*
- *Note: as H.715 was vetoed at the end of the 2022 legislative session, the CHS has not yet been enacted in Vermont. However, the bill provides an excellent overview of issues and structural elements for those considering a CHS.

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

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Principal
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Northeast Energy Efficiency Partnerships (NEEP)

California's Emissions Reductions Programs

CT Comprehensive Energy Strategy Session 8

Erin Cosgrove

Public Policy Manager

Northeast Energy Efficiency Partnerships

CA's Emissions Reductions Programs

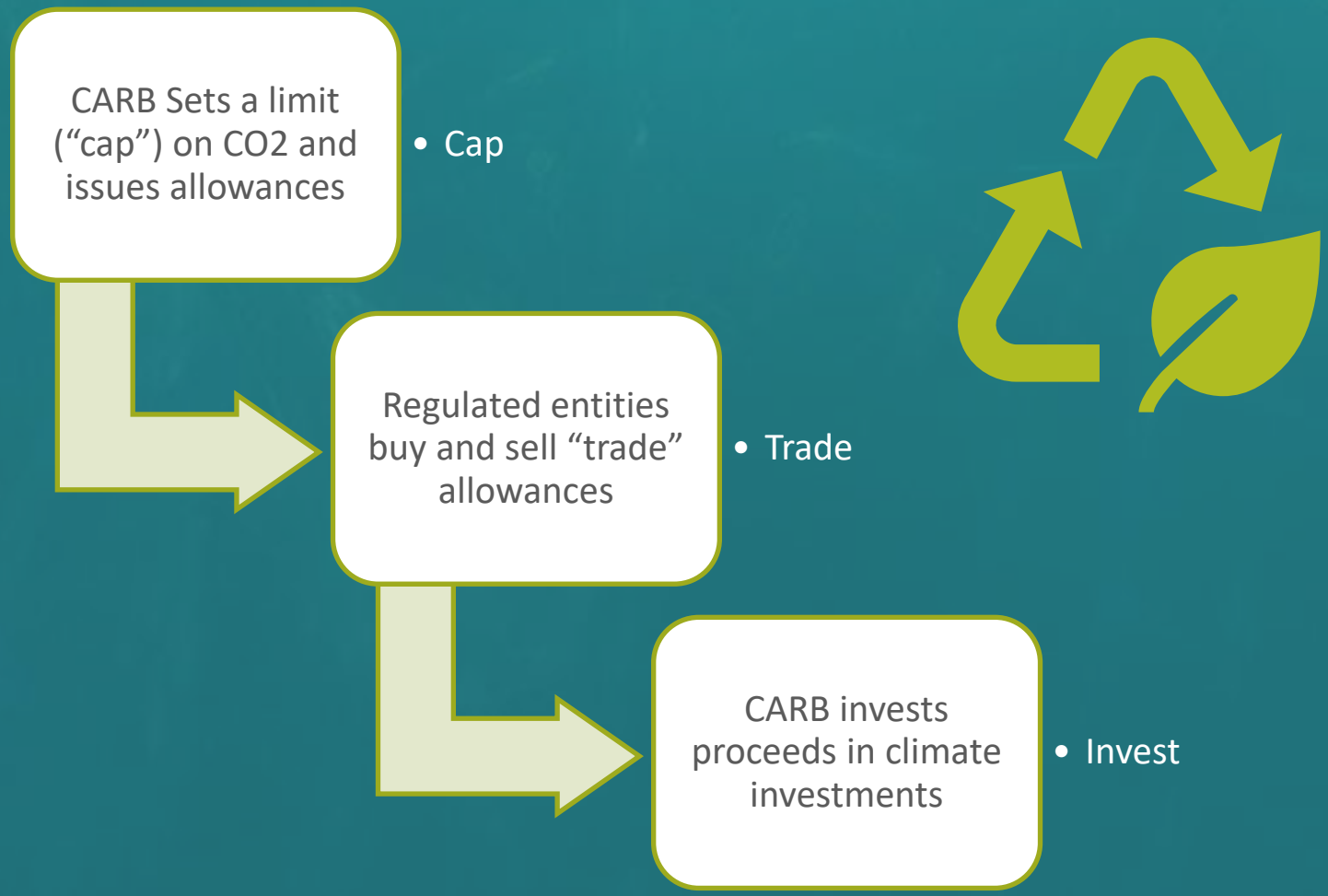
- Cap-and Trade Program
- Low Carbon Fuel Standard
- Lessons Learned
  - Benefits
  - Equity Considerations
  - Workforce Considerations

Pricing Emissions for Decarbonization

Emission Tax	• Programs apply a price to each metric ton of a pollutant emission, such as carbon dioxide. This mechanism increases the costs of emissions to encourage businesses to lower pollutants.
Cap-and-Trade	• Programs set a cap that declines over time and create a limited pool of credits that regulated entities can buy or bid on in an auction to allow them to pollute. This allows the market to determine the price of emissions.
Cap-and-Invest	• Programs operate similar to cap and trade programs, but auction allowances are invested into programs that further the policy and uplift communities.

California's Cap-and-Trade Program

How CA's Cap-and-Trade Works



Source: http://www.edf.org/sites/default/files/californias-cap-and-trade-program-step-by-step.pdf

Capping Regulated Entities

Natural Gas and Propane Distributors

Industrial Operations

Electric Generation Facilities

Transportation

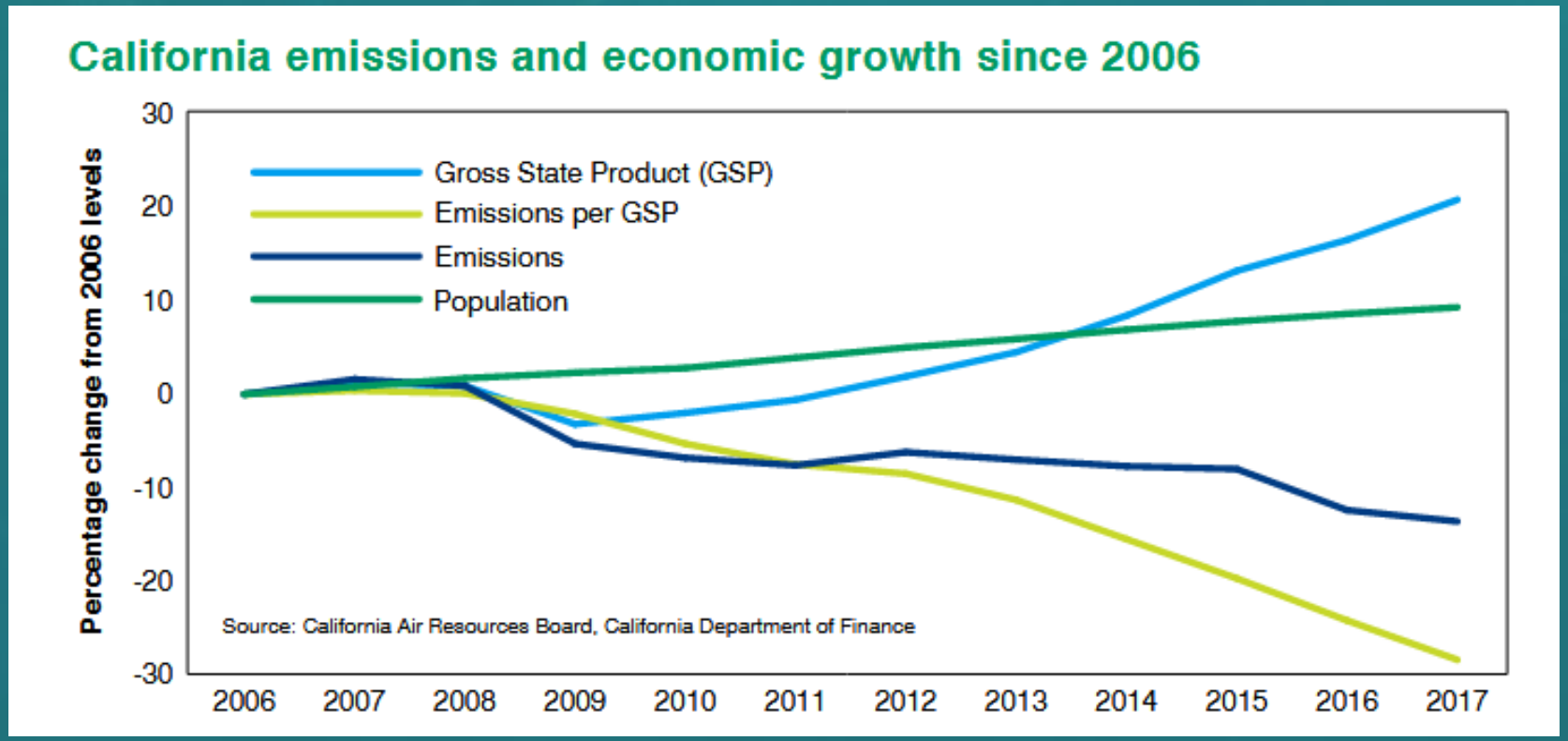
Investing in Decarbonization Programs

Equitable Building Decarbonization Program

Consumer Education

Expanding Incentives For Retrofits

Lowers Emissions and Grows Economy

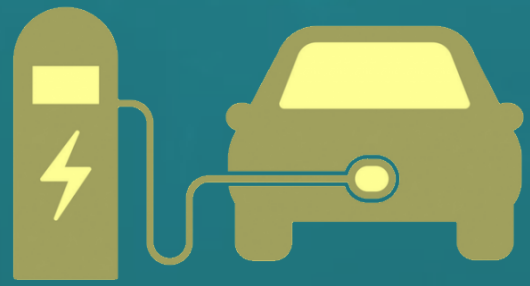


Source: http://www.edf.org/sites/default/files/californias-cap-and-trade-program-step-by-step.pdf

California’s Low Carbon Fuel Standard

Low Carbon Fuel Standard

- Goal is to reduce carbon intensity of transportation fuel by 20% by 2030.
- Sets annual carbon intensity standards or benchmarks for gasoline, diesel, and the fuels that replace
  - Emissions measurements based on complete lifecycle analysis
- Regulated entities buy and trade credits to meet the cap
  - Allows market to determine mix of fuels
- Adopted by Oregon, Washington, British Columbia, European Union, and United Kingdom



Lessons Learned from California

Cap-and-Trade Benefits

Complements Other Decarbonization Policies

Provides Flexibility in Solutions

Grows Clean Energy Economy

Invests in Climate Solutions

Cap-and-Invest Policy Considerations

Equity Considerations

- **Meaningfully engage stakeholders** with accessible meetings at every stage of program design and implementation
- **Embed guardrails** to ensure the emissions cap does not disproportionately impact underserved communities
- **Prioritize restorative justice** in investments
  - Uplift communities with programs
  - Work to undo disproportionate impacts of the energy system

Workforce Considerations

- Policy can **transition whole industries** to clean energy.
- **Uplift Workers** by offering workforce transition pathways and training.
- **Invest in communities** that will be impacted by industry closures or winding down.

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Synapse Energy Economics

Market-Based Decarbonization Policies: Examples from Other Jurisdictions

December 15, 2022

Olivia Griot, Synapse Energy Economics

 |

Outline

- What are market-based decarbonization policies?
- Examples of policies from other jurisdictions
- Examining market-based decarbonization policies through 5 lenses

What are market-based decarbonization policies?

- Policies that put a price on carbon emissions, incentivizing emitters to reduce carbon-intensive fuel use in favor of low-carbon energy sources
- These policies can put a price on emissions in the form of a tax, fee, or fine or can establish a market for trading a limited supply of allowances for carbon emissions (cap-and-trade)
- Common forms of market-based/carbon pricing decarbonization policies:
  - Cap-and-trade
  - Low carbon fuel standards
  - Thermal RPS programs
  - Building performance standards
  - Clean heat standards

Cap-and-Trade

- European Union Emissions Trading System (2005 – Present)
  - Covers CO_2, NO_2, and PFC emissions from around 10,000 installations in the power sector and manufacturing industry, as well as airlines operating between EU countries.
  - Cap set to reach -40% relative to 1990 emissions level by 2030 with an annual cap reduction of 2.2%.
  - Free allocation of allowances for certain industries in order to maintain international competitiveness of those industrial sectors at risk of carbon leakage.
- The Regional Greenhouse Gas Initiative (RGGI) (2009 – present)
  - Market in CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, & VA to cap power sector CO_2 emissions.
  - Market mechanism to auction off CO_2 allowances, creating a pay-to-pollute system that further disincentivizes carbon intensive fuel use. Auction proceeds are reinvested into communities.
- California's Cap-and-Trade Program (2013 – present)
- Washington's Cap-And-Invest Program (begins January 2023)
  - Sets a cap on carbon emissions in the state and requires businesses to obtain allowances equal to their greenhouse gas emissions. The cap will be reduced over time to further incentivize decarbonization.
  - Covers businesses that generate emissions that exceed 25,000 metric tons of CO_2e per year.
  - Fines for non-compliance of up to $50,000 per violation, per day.

Low carbon fuel standards

- UK Renewable Transport Fuel Obligation (2012 – Present)
  - Transportation fuel suppliers must be able to show that a percentage of the fuel they supply comes from renewable and sustainable sources (currently 14.6%).
  - Covers fuel suppliers that supply at least 450,000 liters of this fuel per year.
  - Suppliers certified as having sold more than the 14.6% obligation are able to sell their excess certificates to those who sold less than the obligation.
- California Low Carbon Fuel Standard (2011 – Present)
- Washington Clean Fuel Standard (Begins January 2023)
  - Requires fuel suppliers to gradually reduce the carbon intensity of transportation fuels to 20 percent below 2017 levels by 2038.
  - Reductions can come from:
    - Improving the efficiency of fuel production processes
    - Producing and/or blending low-carbon biofuels into fuels sold
    - Purchasing credits generated by low-carbon fuel providers, including electric vehicle charging providers
  - Predicted to slightly increase gas prices (1-cent per gallon in 2023, 2-cents per gallon in 2024, and 4-cents per gallon in 2025) while delivering $1.8 billion in health benefits.

Thermal Renewable Portfolio Standard (RPS) programs

- New Hampshire Thermal RPS (2007 – present)
  - New Hampshire's RPS statute requires electricity providers to meet customer load by purchasing or acquiring certificates representing generation from renewable energy.
  - This program allows electric utility customers to generate RECs for thermal energy that can be sold to electric utilities to comply with the RPS.
  - In lieu of meeting the portfolio requirements, an electricity provider may make payments into a renewable energy fund.
- Maryland Thermal RPS (2012 - Present)
  - Maryland's RPS classifies renewable thermal technologies as Tier I resources.
  - Covers thermal energy from solar water heating, geothermal heating and cool, and thermal energy from biomass systems.
  - Solar water heating is eligible for the solar carve out.

Building performance standards

- New York City Local Law 97 (passed in 2019)
  - Buildings over 25,000 square feet will be required to meet new energy efficiency and greenhouse gas emissions limits by 2024, with stricter limits coming into effect in 2030. Penalty fines will be enforced for non-compliance.
  - City considering implementing a carbon trading program as a compliance mechanism for meeting emissions limits.
- Boston Building Emissions Reduction and Disclosure Ordinance (BERDO) (passed 2021)
  - Buildings over 20,000 square feet meet a series of emissions intensity targets starting in 2025 and reach carbon neutrality in 2050.
  - Offsite renewable electricity purchase that meets specific criteria is an available compliance pathway.
  - Fines equal to $234 per metric ton of CO_2e in excess of each building's target.
- Colorado Building Performance Standards (in effect June 2023)
  - Building performance standards apply to all commercial, multifamily, and public buildings 50,000 square feet and larger.
  - Standards under development to align with GHG reduction targets; recommendations for non-compliance penalties above the cost of compliance.
- Other jurisdictions have building performance standards; not all have GHG requirements.

Clean heat standards

- Finland's National Energy and Climate Strategy (2021 – 2030)
  - Requires a 10% blend of bio-liquid fuels in heating oil by 2030.
  - By 2025, oil heating will be banned in state owned properties.
  - Variable tax rates on different fuel types make biofuels a much lower taxed option than fossil oil and gas.
- New York State Clean Heat Program (2021)
- MA Commission on Clean Heat (2022)
- Colorado Clean Heat Plans (begins in 2023)
  - Gas utilities will develop "Clean Heat Plans" that cut emissions at the lowest reasonable cost through a mix of supply-side resources which replace traditional gas and demand-side resources which reduce the gas customers use.
  - May include energy efficiency programs, methane recovery, green hydrogen use, and beneficial electrification.
- Vermont Clean Heat Standard (possible 2023)

Carbon Pricing Through 5 Lenses

- Climate: Carbon pricing can incentivize decarbonization by making high-carbon activities prohibitively expensive, but climate goals may not be achieved if prices are not high enough.
- Equity: Equity can be embedded into program designs, ensuring that the burden does not fall on environmental justice or energy burdened communities. Program funds can be reinvested in these communities. However, market-based mechanisms can result in uneven distribution of certain benefits, like health benefits, if the programs are not designed with equity in mind.
- Affordability: Some programs can lead to affordability improvements by encouraging energy efficiency and beneficial electrification. Others may lead to higher costs if they are not designed with least-cost provisions.
- Economic Development: Carbon pricing programs can create new jobs while lowering supply chain costs. However, jobs based in fossil fuel production may be lost.
- Resilience: Increasing renewables through distributed generation can improve resilience because it allows power to be generated locally. However, wind and solar are intermittent sources of power than can be disrupted by extreme weather if they are not paired with storage.

Contact Information

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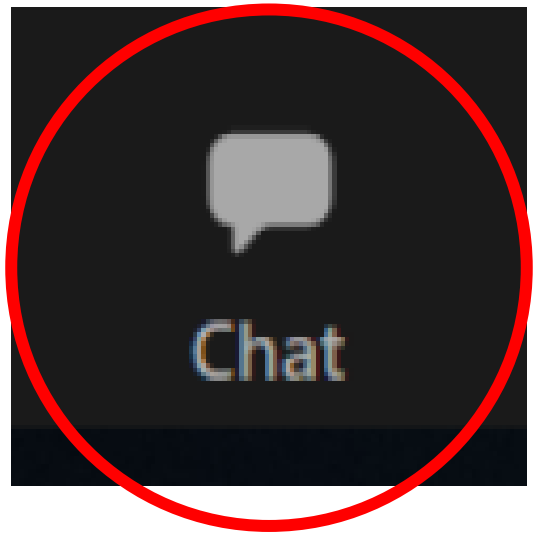
Questions



At the conclusion of each panel DEEP will hold a brief question and answer period.

If you have a question for a presenter, please drop it into the chat to **Jeff Howard**. DEEP will pose as many questions as time allows to the speakers. Clarifying questions will be prioritized. Leading questions will not be accepted.

Lunch Break

(we'll restart at 1:00 p.m. ET)

BUREAU OF ENERGY AND TECHNOLOGY POLICY