From:	**notoriousnef** <notoriousnef@yahoo.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Gas car ban
Date:	30.08.2023 13:47:48 (+02:00)

Hello,

Are you seriously trying to do this? Are you providing vouchers to help cover cost of electric vehicle? What about the environmental impact of creating more energy to spend charging said vehicles? It will cause more harm than good. Do not give that nazi lamont the rights to ban car.

Sent from my Verizon, Samsung Galaxy smartphone

From:	**picabo0987@netzero.net** <picabo0987@netzero.net>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	gas powered cars
Date:	30.08.2023 17:34:46 (+02:00)

Greetings,

Good We are a working family who will not be able to budget for expensive EV cars.

I am requesting that you say NO to eliminating gas powered cars in CT.

Regards,
Mr. & Mrs. White
Southbury

From:	**Suzie Murphy** <murphysuzie1@gmail.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Keep Gas powered cars
Date:	30.08.2023 12:18:14 (+02:00)

To whom it may concern,

I am NOT for electric vehicles.

It should be our choice what kind of car to purchase. And our choice should be supported!

Thank you

Respectfully

Suzie Murphy

Sent from my iPhone

From:	**kurt@ctmulch.com** <kurt@ctmulch.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Light-Duty Proposed Emission (NOx) and the Medium and Heavy-Duty Proposed (MHD)
Date:	30.08.2023 11:49:02 (+02:00)
Attachments:	CCE_001133.pdf (1 page)

Kurt Lindeland
70 Mullen Road
Enfield, CT 06082
Phone 860-698-9579
Fax 860-698-9581
www.connecticutmulch.com

Connecticut Mulch
Distributors, Inc.
Covering ground since 1977

Connecticut Organics

Connecticut Forest Products

Dear Commissioner Dykes,

These regulations could upend the transportation sector, if regulators do not pay close attention to the cost and speed at which they require Connecticut residents to adhere to these lofty requirements.

The costs associated with motor carriers coming into compliance with the regulations before us are exorbitant. The costs range into the billions. It is difficult to capture all the related costs since most of the incurred costs are too far off and or simply unknown.

For instance, a new electric truck costs approximately $500,000. (We have 40 trucks – this would put us out of business) Where a diesel truck currently costs $100,000.

Charging stations charging stations cost $100,000 each. And, you will need one charging station per truck.

These costs could be offset by grants and subsidies. Over the last 12 years California has committed close to **2.5 billion** for the purchase of lower emitting vehicles.

Connecticut has NOT come close with regards to making a similar financial commitment. In fact, CT has fallen excessively short when it comes to subsidizing the transition.

In addition to costs there are several other concerns with the proposed:

- battery technology is premature
- grid lacks capacity to meet goals of regulation
- EPA standard over CARB equaling one national standard
- safety concerns (ex. Battery fire)
- hydrogen a better solution
- CA policy makers driving CT policy

The passing of regulations that are unattainable is never a good policy. Identically adopting California's regulations cedes authority to California policy makers. There undoubtedly will be sections of California regulations that simply don't work in Connecticut or worse add to the cost by requiring Connecticut to comply with an overly aggressive timeline. To offset these types of untended consequences it seems wiser to allow Connecticut policy makers to decide what is best for our state.

Sincerely,

Kurt Lindeland – VP

Connecticut Mulch Distributors, Inc.

From:	**Reba Stoddard** <rebastoddard@att.net>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Mandating EV
Date:	30.08.2023 05:59:58 (+02:00)

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How will people be able to afford these vehicles which are more expensive than a gas powered car? To mandate this forces people into things they can not afford. Connecticut is forcing people who have lived in this state for their entire lives out of it because they can not afford to live here and this is another example. Maybe you should mandate all of the private jets that pollute more than cars and trucks to be all electric? Not to mention the infrastructure can not handle it. Let’s put some more money in Eversource and UI’s pockets since electric rates doubling wasn’t enough. Is Connecticut going to be the next California? That is what it seems like because that has worked so well that people are leaving California in droves. Is that what you’re trying to do Governor Lamont? We have way bigger problems in this state and country to deal with than electric cars but that is the focus? I am all for protecting the environment but this is not the way. Mandating things takes away choices which is what our country was founded on. We seem to be forgetting these fundamental principles with everything lately.

Reba Stoddard RN

Disgusted in Mystic

Sent from my iPad

From: **Elizabeth Kiernan** <elizabethjkiernan@gmail.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Misinformation
Date: 30.08.2023 16:18:20 (+02:00)

-Challenging false information spread by the oil industry is of utmost importance. These initiatives for cleaner transportation have been under development for many years, and the Connecticut legislature organized public hearings and passed laws in 2022 to establish these updated regulations. Ample time exists for putting these plans into action, and additional delays are not reasonable.

Please make a difference!

Elizabeth Ramirez Kiernan
Ridgefield CT

From:	**Mark A Mitchell** <mmitch3@gmu.edu>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Mitchell Comments on ACCII/ACT Docket
Date:	30.08.2023 20:12:27 (+02:00)
Attachments:	Comments in Support of the proposed DEEP ACCII-ACT Standards.docx (1 page)

Dear CT DEEP Professionals,
Attached and below are my comments in support of the proposed Advanced Clean Cars II and the Advanced Clean Trucks regulations. Thank you for giving me the extended opportunity to comment and the alternative means to submit comments outside of your eRegulations website, which I can't figure out. ☺

Please acknowledge receipt and let me know if you have questions.

Best,
-MM

Mark A. Mitchell, MD MPH FACPM
Associate Professor, Climate Change, Energy & Environmental Health Equity
Center for Climate Change Communication
George Mason University
Mmitch3@gmu.edu
(860) 794-9497
www.gmu.edu

Comments in Support of the proposed DEEP Advanced Clean Cars II and the Advanced Clean Trucks Regulations and Why They are Needed by Environmental Justice Communities

By

Mark A. Mitchell MD, MPH

August 30, 2023

Dear Commissioner Dykes,
As you know, I am Associate Professor of Climate Change, Energy & Environmental Health Equity at George Mason University. I am also Co-chair of the Connecticut Equity and Environmental Justice Advisory Council with you. Additionally, I founded Connecticut Coalition for Economic and Environmental Justice and am Senior Advisor to this group. I founded the group in 1998 and led our establishment of chapters in Hartford, Bridgeport and New Haven, have been working with environmental justice communities across Connecticut since then. **I am writing to let you know why these proposed regulations are critical for environmental justice communities in Connecticut.**

From and environmental justice point of view, adopting strong clean cars and clean truck rules are critically important. My neighborhood, for example, is one of the lowest wealth neighborhoods in the State of Connecticut and is 94% people of color. Almost half of the households here do not have automobiles, yet we are in the highest 5% of exposure to traffic in the nation due to the proximity to highways and the heavy traffic from suburbanites and others who work in nearby businesses, according to EPA's Environmental Justice screening tool. We need these drivers to switch to electric vehicles in order to reduce the high traffic-related pollution and asthma rates in our neighborhood.

In addition, to assist environmental justice communities, we need more clean trucks, buses, and fleets, as well as additional state incentives to enable lower-income residents to purchase new and used EVs. As more cars, trucks and buses convert to electric, we can expect the prices to drop and the availability of used EVs to increase.

In summary, adoption of the ACCII/ACT coupled with increased incentives, such as through the CHEAPR program, for low-wealth individuals will improve health and increase access to healthy transportation for all Connecticut residents, especially those who need it most.

Best,
-Mark Mitchell MD, MPH
Mmitch3@gmu.edu

Comments in Support of the proposed DEEP Advanced Clean Cars II and the Advanced Clean Trucks Regulations and Why They are Needed by Environmental Justice Communities

By

Mark A. Mitchell MD, MPH

August 30, 2023

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Best,

-Mark Mitchell MD, MPH
Mmitch3@gmu.edu

From: **Marion Gehlker** <marion.gehlker@yale.edu>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Mobile Sources
Date: 30.08.2023 09:00:46 (+02:00)

-Connecticut is facing an air quality crisis due to car and truck emissions, which account for nearly 40% of the region's greenhouse gas emissions. This problem puts public health at risk, exacerbates environmental disparities, and adds to the instability of our climate. It's crucial to implement stronger standards promptly to address these issues effectively.

-The transportation plans under review can potentially reduce yearly greenhouse gas emissions by 1.48 million metric tons by 2040. Acting quickly and adopting these regulations before the year ends is essential to reaching this goal.

-The new standards also take into account environmental justice, particularly impacting lower-income neighborhoods and moderate-income areas close to busy roads like I-95. Diesel fumes, which are known to cause cancer, result in severe health problems such as lung cancer, heart disease, and asthma. These communities bear the brunt of the air pollution caused by transportation.

-Transitioning to medium and heavy-duty vehicles with zero emissions doesn't only lead to cleaner air; it also decreases greenhouse gas emissions. Connecticut is in sync with states such as Rhode Island, Maryland, New Jersey, and New Mexico, highlighting the importance of regional collaboration, including Massachusetts, New York, and Vermont.

-These initiatives don't prohibit gas-powered vehicles. Instead, they raise the percentage of new electric vehicle sales between 2027 and 2035, ultimately culminating in a complete shift to 100% electric vehicle sales within participating states. This strategy offers consumers a wider range of options when choosing vehicles.

-Challenging false information spread by the oil industry is of utmost importance. These initiatives for cleaner transportation have been under development for many years, and the Connecticut legislature organized public hearings and passed laws in 2022 to establish these updated regulations. Ample time exists for putting these plans into action, and additional delays are not reasonable.

-The necessary technology for the implementation of these standards is already established. Electric vehicles are becoming more cost competitive, and there's significant financial backing from federal acts such as the Inflation Reduction Act of 2022 and the Infrastructure Investment and Jobs Act of 2021 to support the expansion of our electric infrastructure.

-Those who are against these regulations aren't genuinely advocating for the people of Connecticut – they are advancing the interests of the oil industry and prolonging our dependence on polluting gas

-Better yet: Improve public transportation and bike lanes, access to bicycles, creatively use school buses when not used for schools,

Solar bus conversion kit: https://sonomotors.com/

Marion Gehlke
19 Timberwood Trl
Hamden, CT

From: **Kenneth Younkin** <younkin235@gmail.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: News clean vehicle regulation controversy…
Date: 30.08.2023 14:16:22 (+02:00)

As a grandfather, I think it's time my elected representatives actually work towards what I want them to work for, and that is making our climate better for our grandchildren and their children please pass these new laws!

Kenneth Younkin
Chester, Ct.

From: **Susan Cote-DeMilia** <scotedemilia47@yahoo.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: new standards for clean cars and trucks
Date: 30.08.2023 20:54:47 (+02:00)

I support the adaptation of new standards for clean cars and trucks.

The transportation plans under review can potentially reduce yearly greenhouse gas emissions by 1.48 million metric tons by 2040. Acting quickly and adopting these regulations before the year ends is essential to reaching this goal.

Thank you,

Susan Cote-DeMilia
136 Jacob Rd. Southbury CT 06488

From: **Ann Marie Matto** <amatto@yahoo.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: No ban on gas cars!!!!!
Date: 30.08.2023 09:50:52 (+02:00)

NO BAN ON GAS CARS!!

No time for people's voices to be heard?!
UNFAIR!!

From:	**June Fliri** <maryjune01@sbcglobal.net>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	No ban on gas powered vehicles
Date:	30.08.2023 10:08:19 (+02:00)

I wish to have a choice on the type of vehicle I drive. I Do NOT want to be forced to have an electric vehicle. Do not pass/ agree to this idea

June fliri

Sent from my iPhone

From:	**Jeffrey Caporaso** <jcaporasophd@yahoo.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	NO ban on new gas vehicles
Date:	30.08.2023 02:50:57 (+02:00)

Hello,

Very simply put, banning the sale of new gas cars in the near future would destroy the middle and lower class' opportunities to travel. Electric cars are not affordable. Used car sales will skyrocket. We are already stressed financially thin in this state.

This is a horrible idea.

Jeff C

From:	**Czarnecki, Keith** <KCzarnecki@enterbuilders.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
CC:	**lou@armanirestoration.com** <lou@armanirestoration.com>; **Mike Pinette** <mike@ctcomfortcontrol.com>; **Peter Friel** <cindyshallmark@sbcglobal.net>; **Adam Tokarzewski** <info@ucllc.com>; **Anthony Guerrera** <AnthonyJr@agodevelopment.com>; **John LaRosa** <John@larosacc.com>; **Jeffrey Giantonio** <jgiantonio@smithbrothersusa.com>; **Gregory Giantonio** <greggiantonio@hotmail.com>; **Czarnecki, Wayne** <WCzarnecki@enterbuilders.com>; **Kevin Czarnecki** <Moisty74@gmail.com>; **Richard, Kyle** <KRichard@enterbuilders.com>; **Barone, Matt** <MBarone@enterbuilders.com>; **John Visgilio** <jvisgilio@overabove.com>; **John Wagner** <johnwagner111@live.com>; **Drag, Pawel** <PDrag@enterbuilders.com>; **Dave Carbo** <crb597@yahoo.com>
Subject:	NO EV
Date:	30.08.2023 09:10:49 (+02:00)

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Fu…….this BS attempt to regulate.

You people ought to have your heads examined

THE ENVIRONMENTALIST ARE ONCE AGAIN KILLING THE ENVIRONMENT!!!!

This state of Ct ought to be ashamed of itself with its far left commitment to destroy the beautiful state of Ct and its livelihood with all this false salesman ship of EV BS demands

LIKE THE WIND FARM BS THAT IN FACT is KILLING OUR OCEAN / WHALES YOU PEOPLE TOO WILL NOT BE HAPPY UNTIL YOU KILL OFF THE PEOPLE WHO make your jobs possible

STOP ● IT !!

NO EV’s!!!

Keith Czarnecki

Sent from my iPhone

From:	**Robert MacDuff** <rmacduff@comcast.net>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	No EV Mandate!
Date:	30.08.2023 09:16:16 (+02:00)

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I am writing to convey my disappointment with the Lamont administrations attempt to further control State residents choice of transportation.

Prohibiting the sale of gas powered vehicles by 2035 in CT will not measurably improve our air quality and will place a financial burden on many families.

Believe it or not there is a carbon footprint associated with "clean energy" e.g. the manufacturing of solar panels (limited life expectancy) batteries, and wind turbines, etc. The mining of materials to manufacture the support system for renewable energy is damaging to the environment too.

Also, as we all know the cost of electricity is trending upward and the current grid system will not adequately support the many needed charging stations. The cost for upgrades to the grid will certainly be passed on to the working consumer once you have us locked in to EVs

No EV mandates!

Stop the nonsense!

Robert MacDuff

From: **jennifer martocci** <4jjean@gmail.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: No EV please!
Date: 30.08.2023 11:59:46 (+02:00)

Please!!!
I can’t afford to get or have my children get an EV. Please vote NO!!
Jen

From: **SHANNON OBRIEN** <shannonobrien2@comcast.net>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: NO to a ban on gas-powered cars in CT
Date: 30.08.2023 16:44:35 (+02:00)

As an American citizen, I am writing to you this afternoon in opposition to the proposed ban on gas-powered cars in CT. I oppose the proposed electric vehicle mandate. I believe this is an extreme agenda that will dramatically change the economic landscape of the State of CT. An electric vehicle mandate will create barriers to access to affordable cars and barriers to move freely and efficiently throughout our State. I oppose this very un-American agenda being pushed by unelected bureoucrats who are unaccountable to the American citizens residing in CT.

I oppose the ban on gas-powered cars in CT. I believe this mandate is incongruent with the founding principles and values of our nation. I will simply state my position, "no".

From: **Jackie MacKnight** <jackiemacknight@gmail.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: NO to a ban on gas powered cars in CT in 2035
Date: 30.08.2023 09:40:39 (+02:00)

I firmly stand against the proposed ban on gas powered cars in CT in 2035. There are a vast number of reasons but many include loss of work for many, financial hardships, electric rates, new car purchases, mechanics training, and more. Please do not allow this to pass.

Jackie MacKnight

From: **Oshana, Kim M** <kim.oshana@cbmoves.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: NO to ban on gas-powered cars in CT
Date: 30.08.2023 12:44:09 (+02:00)

Banning gas powered cars is absolutely insane! This will cause major financial problems for lower- and middle-class families. It will also put a huge burden on our power grid. Electricity is produced by burning coal which is horrible for the environment. What benefit is it really to ban gas powered cars? There is none!

Wake up!
Kim Oshana

From:	**Jodi L** <jodilrealestate@hotmail.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	No to ban on gas powered vehicles
Date:	30.08.2023 14:30:38 (+02:00)

To whom it may concern:

I am a Connecticut tax payer, as a free and private citizen of the state of Connecticut and the USA I am saying no to the ban of gas powered cars in CT.

Thank you

Jodi Lisitano

From:	**Mary Lou Bevvino** <mbevvino@icloud.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	No to Electric Cars
Date:	30.08.2023 18:16:56 (+02:00)

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Pls vote NO to banning any enforcement of electric cars.

Mary Lou Bevvino, GRI,ABR
Relocation and Luxury Home Specialist
Berkshire Hathaway HS -NE Properties
1583 Post Road, Fairfield, CT 06824
Cell 203-526-1064
Synchronizing Buyers and Sellers Since 1996
CT Magazine Five Star Professional 2012-2020

"A Referral Is The Highest Form of Compliment"

From:	**Mary T** <maryt320@gmail.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	No to electric cars
Date:	30.08.2023 12:15:01 (+02:00)

Vote No

"NO" to a ban on gas-powered cars in CT

Stop the nonsense! My family does not want an undependable electric car!

From: **Sarah Osborne** <sarah_d_osborne@yahoo.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: No to ending sale of gas cars
Date: 30.08.2023 09:54:18 (+02:00)

This is a ridiculous proposal and I for one would move out of state. I do not support banning the sale of gas cars.

Sarah Osborne
Lyme, CT

Sent from Yahoo Mail for iPhone

From:	**Amy Chai** <amy.f.chai@gmail.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	No to gas powered vehicle ban
Date:	29.08.2023 18:43:37 (+02:00)

No.

This ban is REGRESSIVE and harms the poor and the self employed the most. CT government employees can work from home, but most poor cannot do so. Transportation is survival. The poor often park on the street and have no access to a garage with an electric power station.

The ban is SHORTSIGHTED and precedes a stable and affordable electric grid in our state. We import our electric. Our wires are aboveground. We have frequent power outages. We have no nuclear power and our grid cannot begin to handle the challenge now or in the near future.

The ban will NOT SOLVE for climate. The greenest vehicle is the car you already own. Scratch the surface of green policy and you will find green graft snd grifters who profit immensely at our expense.

Don’t fall for the corporate faux green agenda!

Regards,

Amy Fogelstrom Chai, MD, MS

North Haven

Sent from my iPhone

From:	**Tom Cherry** <candlewoodangels@gmail.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	No to mandates eliminating gasoline powered automobiles
Date:	30.08.2023 08:12:37 (+02:00)

Any mandate banning the sale of gasoline cars in the state of Connecticut will harm low income, families, and those self-employed in the gig economy by making cheap transportation unavailable. Moreover, the electrical infrastructure throughout the state of Connecticut is antiquated and inadequate to support charging with a rapid or slow of electric vehicles.

Many aspects of the anti-fossil fuel political agenda are not fully researched, or thought through.

I am completely against any mandate by the government, forcing gasoline powered vehicles off the roads

T Cherry

Madison

From:	**alma Elder** <Elder106@comcast.net>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Okay to EVs
Date:	30.08.2023 13:31:01 (+02:00)

This is in support of the Governor’s bill to stop selling gas-powered new cars in 2035 and to all and promote electric vehicles. Last July was the hottest on record. Last year was the hottest on record. We must stop CO2 and Methane from polluting the atmosphere. Please allow TVs. Alma Elder, 106 WEST STREET, Middlefield, CT. 06455

From:	**skirkman@petroheat.com** <skirkman@petroheat.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Opposed to Proposed CARB Regulations
Date:	30.08.2023 15:58:11 (+02:00)

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Dear DEEP:

As a business located in Connecticut that uses trucks to deliver fuel, I am expressing my opposition to the proposed Medium and Heavy-Duty Vehicle Low NOx and Advanced Clean Trucks and Low Emission Vehicle IV and Zero Emission Vehicle Regulations.

These regulations were developed by the state of California without any contributions by Connecticut businesses and residents. It is fundamentally wrong for our state to adopt regulations that were designed to meet the needs of another state that is vastly different than ours is.

My understanding is that Connecticut is preempted from adopting the California Air Resources Board's (CARB) Advanced Clean Cars (ACC) II standards. You must consider whether the measures called for in the California ACC II rule conflict with or are otherwise preempted by the statutory mandates of federal legislation such as the Energy Policy and Conservation Act (EPCA); the federal Clean Air Act (CAA), including the Renewable Fuel Standard (RFS) program; and the Energy Independence and Security Act (EISA).

EPCA expressly preempts states from adopting regulations "related to" fuel economy standards, and ACC II falls squarely within that preemptive footprint. Congress did not authorize the National Highway Traffic Safety Administration (NHTSA) or the Environmental Protection Agency (EPA) to waive this express preemption and therefore Connecticut should not move forward with these regulations.

ACC II is also expressly preempted by the CAA. Unlike EPCA, EPA may waive federal motor vehicle emissions standard preemption under the CAA under certain conditions. However, California has not obtained a preemption waiver from EPA for ACC II. Not only has California not obtained a waiver for ACC II, ACC II is not a valid subject for an EPA waiver.

DEEP should be aware that straight job trucks that deliver Bioheat fuel and bobtail trucks that deliver propane have no electric option. Since half the homes in the state use these fuels we will be forced to keep older and less efficient trucks on the road longer as these regulations do not provide for an alternative way to comply with them.

Gasoline and diesel fuel is delivered in larger tanker trucks who will also be adversely impacted in a number of ways. Since Connecticut limits the weight of these vehicles to 90,000 pounds - the increased weight of the truck due to the added weight of the battery will require us to make more deliveries to get the same number of gallons to their destination. This increases labor costs by requiring drivers to make more trips and added traffic congestion due to more back and forth trips between the terminal and retail stores. All of these costs will result in higher prices at the pump.

If the Medium and Heavy-Duty Vehicle Low NOx and Advanced CleanTrucks regulations pass, we will be required to spend more money on electric charging equipment and to spend more on electric trucks than their diesel counterparts. Medium and heavy duty truck chargers can cost as much as $100,000 each and electric trucks can be as much as five time more expensive than diesel trucks. The small business impact statement for these regulations state that they will not have a fiscal impact on businesses. This is patently false.

I ask that DEEP suspend this regulation making process so that the Connecticut General Assembly can reevaluate the impact that adopting California regulations will have on Connecticut and our business. This process falls short of stating the true cost to consumers (especially low and middle-income families), businesses, and the government. It fails to consider actual emissions from grid electricity compared to ICE's. It ignores electric reliability issues. Avoids dealing with substantive issues about the inadequate charging infrastructure and electric distribution infrastructure. And does not consider the real environmental impact that the transition to EV's will have on the environment from a lifecycle standpoint.

Sincerely,

Sean Kirkman

22 Rivercliff Drive

Milford, CT 06460-5018

From:	**Robin Shea** <mailagent@thesoftedge.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Opposed to Proposed CARB Regulations
Date:	30.08.2023 14:42:11 (+02:00)

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These regulations were developed by the state of California without any contributions by Connecticut businesses and residents. It is fundamentally wrong for our state to adopt regulations that were designed to meet the needs of another state that is vastly different than ours is.

My understanding is that Connecticut is preempted from adopting the California Air Resources Board's (CARB) Advanced Clean Cars (ACC) II standards. You must consider whether the measures called for in the California ACC II rule conflict with or are otherwise preempted by the statutory mandates of federal legislation such as the Energy Policy and Conservation Act (EPCA); the federal Clean Air Act (CAA), including the Renewable Fuel Standard (RFS) program; and the Energy Independence and Security Act (EISA).

EPCA expressly preempts states from adopting regulations "related to" fuel economy standards, and ACC II falls squarely within that preemptive footprint. Congress did not authorize the National Highway Traffic Safety Administration (NHTSA) or the Environmental Protection Agency (EPA) to waive this express preemption and therefore Connecticut should not move forward with these regulations.

ACC II is also expressly preempted by the CAA. Unlike EPCA, EPA may waive federal motor vehicle emissions standard preemption under the CAA under certain conditions. However, California has not obtained a preemption waiver from EPA for ACC II. Not only has California not obtained a waiver for ACC II, ACC II is not a valid subject for an EPA waiver.

DEEP should be aware that straight job trucks that deliver Bioheat fuel and bobtail trucks that deliver propane have no electric option. Since half the homes in the state use these fuels we will be forced to keep older and less efficient trucks on the road longer as these regulations do not provide for an alternative way to comply with them.

Gasoline and diesel fuel is delivered in larger tanker trucks who will also be adversely impacted in a number of ways. Since Connecticut limits the weight of these vehicles to 90,000 pounds - the increased weight of the truck due to the added weight of the battery will require us to make more deliveries to get the same number of gallons to their destination. This increases labor costs by requiring drivers to make more trips and added traffic congestion due to more back and forth trips between the terminal and retail stores. All of these costs will result in higher prices at the pump.

If the Medium and Heavy-Duty Vehicle Low NOx and Advanced CleanTrucks regulations pass, we will be required to spend more money on electric charging equipment and to spend more on electric trucks than their diesel counterparts. Medium and heavy duty truck chargers can cost as much as $100,000 each and electric trucks can be as much as five time more expensive than diesel trucks. The small business impact statement for these regulations state that they will not have a fiscal impact on businesses. This is patently false.

I ask that DEEP suspend this regulation making process so that the Connecticut General Assembly can reevaluate the impact that adopting California regulations will have on Connecticut and our business. This process falls short of stating the true cost to consumers (especially low and middle-income families), businesses, and the government. It fails to consider actual emissions from grid electricity compared to ICE's. It ignores electric reliability issues. Avoids dealing with substantive issues about the inadequate charging infrastructure and electric distribution infrastructure. And does not consider the real environmental impact that the transition to EV's will have on the environment from a lifecycle standpoint.

Sincerely,

Robin Shea

25 Country Hill Road

Naugatuck, CT 06770

From:	**Joe Rumore** <mailagent@thesoftedge.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Opposed to Proposed CARB Regulations
Date:	30.08.2023 10:22:11 (+02:00)

[You don't often get email from mailagent@thesoftedge.com. Learn why this is important at https://aka.ms/LearnAboutSenderIdentification]

EXTERNAL EMAIL: This email originated from outside of the organization. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

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Sincerely,

Joe Rumore

47 BONNIE VIEW DR

Trumbull, CT 06611-4701

From:	**J E** <jena530@hotmail.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	OPPOSING GAS CAR BAN
Date:	30.08.2023 12:50:40 (+02:00)

There has been no time for voices to be heard on this topic!

This is a tyrannic move and we oppose it.

WE THE PEOPLE SAY NO!!!

It’s time you re-read the Constitution. YOU’RE GOING TO NEED IT!!!!!

Jeannine Blue

From:	**Julie Smith/Chris Koppenheffer** <jasctk@me.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Our support for the adoption of new standards for clean cars and trucks
Date:	30.08.2023 08:27:54 (+02:00)

To whom it may concern,

I wonder if any of you have children? Those who are against these regulations aren't genuinely advocating for the people of Connecticut – they are advancing the interests of the oil industry and prolonging our dependence on polluting gasoline.

The necessary technology for the implementation of these standards is already established. Electric vehicles are becoming more cost competitive, and there's significant financial backing from federal acts such as the Inflation Reduction Act of 2022 and the Infrastructure Investment and Jobs Act of 2021 to support the expansion of our electric infrastructure.

In addition, these initiatives don't prohibit gas-powered vehicles. Instead, they raise the percentage of new electric vehicle sales between 2027 and 2035.

If you think CT residents are not paying attention, we are, and we will show you on Election Day.

Thank you for your attention to this matter.

Best,

Julie Smith

293 Weed Street

New Canaan, CT 06840

From: **thomas levine** <taolin33@yahoo.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Please act in support of Clean Vehicle Regulations
Date: 30.08.2023 12:50:32 (+02:00)

I write as a resident of Mansfield CT to ask that you take action in favor of promoting cleaner/less polluting vehicles in our state.

The new regulations proposed attend to social justice. They reduce greenhouse gases and thus promise a better future for our children. They let us stay in sync with states around us passing similar regulations. They allow time for putting plans into actioin, and they use well-established technologies.

Please don't let some industries cause further delays when climate change is such a pressing and urgent problem!

thank you!

tom levine
28 Thomas Drive
Storrs CT 06268

From: **Charles Ermer** <Charles.Ermer.518311506@sendgrassroots.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Please Reject the ACC & ACT
Date: 30.08.2023 18:39:33 (+02:00)

Dear Commissioner Dykes,

As a propane provider in Connecticut, I urge you to reject efforts that would grossly distort the passenger vehicle and commercial truck marketplace by implementing zero-emission (e.g., electric, hydrogen) vehicle delivery mandates. The Advanced Clean Cars (ACC) and Advanced Clean Trucks (ACT) rules seek to increase, on an annual basis, the percentage of zero-emission vehicles (ZEVs) automakers must deliver into the Connecticut market. Flooding the marketplace with more ZEVs will, of course, have an impact on other clean, alternative vehicle fuels, including propane autogas.

While I support efforts to reduce emissions of air pollutants and greenhouse gases from the transportation sector, the Department of Energy & Environmental Protection (DEEP) should take a broader and more practical approach to improve air quality and reduce the carbon intensity of transportation fuels.

Propane autogas, for example, burns cleanly, efficiently and has a low-carbon content. Given propane's clean profile, we can greatly reduce emissions of black carbon, particulate matter and nitrogen oxides from our roadways by displacing legacy fuels, especially across medium- and heavy-duty applications. Remember, even if an electric vehicle lacks a tailpipe, it is not truly zero-emission because our bulk electric grid is not zero-emission. In fact, it is far from it.

Despite government delivery mandates, consumers and businesses will only purchase vehicles that meet their unique transportation needs. Propane-powered vehicles have the power and operating range required to meet the real world demands of commercial transportation, including providing necessary payload to move people and products. These attributes are, in part, the reason school districts across the Constitution State have chosen propane as their preferred clean school bus fuel of choice. Connecticut's harsh climate and high electric rates mean EVs aren't the right answer for everybody. There's certainly no reason DEEP needs to force them upon Nutmeggers. Consumers and fleet managers are well-positioned to decide for themselves what transportation fuels meet their unique needs.

Widespread transportation electrification efforts will have significant impacts on the demand, shape and variability of the electric load. ISO-New England already has issues dealing with peak demand scenarios and severe weather events. The ACC and ACT have the potential to exacerbate these issues.

DEEP should fully consider the true impacts on the electric grid, the environment and the marketplace for competing clean transportation fuels, including propane autogas, before blindly bringing California standards to Connecticut. Please reject the ACC and ACT and, instead, work towards a more realistic and pragmatic way to reduce emissions from the transportation sector.

Thanks for your consideration.

Regards,
Charles Ermer
13 Hall Farm Rd
Atkinson, NH 03811

From: **Bill Cummings** <Bill.Cummings.536199827@grsdelivery.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Please Reject the ACC & ACT
Date: 30.08.2023 16:10:36 (+02:00)

Dear Commissioner Dykes,

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Thanks for your consideration.

Regards,
Bill Cummings
15 Thames St
Groton, CT 06340

From: **Bill Cummings** <Bill.Cummings.536199827@advocacymessages.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Please Reject the ACC & ACT
Date: 30.08.2023 16:10:10 (+02:00)

Dear Commissioner Dykes,

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Thanks for your consideration.

Regards,
Bill Cummings
15 Thames St
Groton, CT 06340

From: **Cece Cushing** <Cece.Cushing.656776472@grassrootsmessage.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Please Reject the ACC & ACT
Date: 30.08.2023 13:01:53 (+02:00)

Dear Commissioner Dykes,

As a propane vehicle service provider in Connecticut, I urge you to reject efforts that would grossly distort the passenger vehicle and commercial truck marketplace by implementing zero-emission (e.g., electric, hydrogen) vehicle delivery mandates. The Advanced Clean Cars (ACC) and Advanced Clean Trucks (ACT) rules seek to increase, on an annual basis, the percentage of zero-emission vehicles (ZEVs) automakers must deliver into the Connecticut market. Flooding the marketplace with more ZEVs will, of course, have an impact on other clean, alternative vehicle fuels, including propane autogas.

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Thanks for your consideration.

Regards,
Cece Cushing
PO Box 413
Auburn, NH 03032

From: **Kim Keil** <Kim.Keil.585241212@advocatesmessage.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Please Reject the ACC & ACT
Date: 30.08.2023 12:55:32 (+02:00)

Dear Commissioner Dykes,

As a propane provider in Connecticut, I urge you to reject efforts that would grossly distort the passenger vehicle and commercial truck marketplace by implementing zero-emission (e.g., electric, hydrogen) vehicle delivery mandates. The Advanced Clean Cars (ACC) and Advanced Clean Trucks (ACT) rules seek to increase, on an annual basis, the percentage of zero-emission vehicles (ZEVs) automakers must deliver into the Connecticut market. Flooding the marketplace with more ZEVs will, of course, have an impact on other clean, alternative vehicle fuels, including propane autogas.

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Thanks for your consideration.

Regards,
Kim Keil
161 Dunbar Rd
Hudson, NY 12534

From: **cade clark** <cade.clark.656474800@forgrassroots.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: Please Reject the ACC & ACT
Date: 30.08.2023 10:25:04 (+02:00)

Dear Commissioner Dykes,

As a propane provider in Connecticut, I urge you to reject efforts that would grossly distort the passenger vehicle and commercial truck marketplace by implementing zero-emission (e.g., electric, hydrogen) vehicle delivery mandates. The Advanced Clean Cars (ACC) and Advanced Clean Trucks (ACT) rules seek to increase, on an annual basis, the percentage of zero-emission vehicles (ZEVs) automakers must deliver into the Connecticut market. Flooding the marketplace with more ZEVs will, of course, have an impact on other clean, alternative vehicle fuels, including propane autogas.

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Thanks for your consideration.

Regards,
cade clark
18 Ward Ave
Millbury, MA 01527

From:	**Fern G** <fern.galperin@gmail.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	Please support Advanced Clean Cars II and Medium and Heavy Duty Emissions Standards
Date:	30.08.2023 12:20:57 (+02:00)

Commissioner Katie Dykes

Department of Energy and Environmental Protection

79 Elm Street

Hartford, CT 06106

Re: Transportation Emissions Regulations

- Advanced Clean Cars II
- Medium and Heavy Duty Emissions Standards & Heavy Duty Omnibus Regulations

Dear Commissioner Dykes,

My name is Fern Galperin and I live at 19 Bellmere Avenue, Stamford, CT. With the rise in asthma and lung cancer cases in our state, particularly in neighborhoods near our notoriously high traffic density highways, it is imperative that the state of CT support two important sets of regulations regarding transportation emissions: the Advanced Clean Cars II regulations and the Medium and Heavy Duty Emission Standards and Heavy Duty Omnibus Regulations.

It goes without saying that transportation emissions play an enormous role in climate change. **It also increases risk factors for cancer. Lung and other cancers in CT are higher than the national average**. **We can no longer ignore the impact of emissions in CT on the health and welfare of our residents. I urge you to help make CT a leader in environmental health.**

The state of Connecticut must adopt these regulations in 2023, so that they can be implemented in the earliest possible year, which is 2027. I believe that we have a moral obligation to protect the planet and all of its inhabitants, ensuring clean air, clean water, and clean land for all.

Thank you for your time.

Best,

Fern Galperin

Stamford, CT

fern.galperin@gmail.com

From:	**Charles Rothenberger** <crothenberger@savethesound.org>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	PR2023-020 Adoption of 22a-174-37 Medium and Heavy-duty Emission Standards
Date:	30.08.2023 21:00:35 (+02:00)
Attachments:	Save the Sound Written Comments on Clean Vehcile Regulations 8.30.23.pdf (8 pages), Save-the-Sound_CT-EV-Policy-Impact-Study_Final_2023-date.pdf (50 pages)

Good afternoon,

Pleased accept the attached comments for Save the Sound in Support of DEEP's proposed ACC II, LEV IV, ACT, and the Low NOx Omnibus regulations.

Don't hesitate to contact me if you have any questions.

Thank you,

Charles J. Rothenberger
Climate & Energy Attorney
Save the Sound
900 Chapel Street, Suite 2202 I New Haven, CT 06510
office: (203) 787-0646, x122
crothenberger@savethesound.org

Save the Sound®
Action for our region's environment.

Save the Sound®
Action for our region's environment.

August 30, 2023

VIA ELECTRONIC FILING

Commissioner Katie Dykes
Connecticut Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106

Email: deep.mobilesources@ct.gov

RE: Proposed Emission Standards for 2027 model year and later Light Duty Vehicles (PR 2023-023)
Proposed Emission Standards for 2027 model year and later Medium and Heavy-Duty Vehicles (PR 2023-020)

Save the Sound is pleased to offer these comments in strong support of Connecticut's adoption of the full suite of regulations being considered (ACC II, LEV IV, ACT, and the Low NOx Omnibus Standards). The regulations build on Connecticut's long-standing commitment to reducing the harmful effects of motor vehicle pollution on our residents and addressing climate change. The standards apply more stringent emissions requirement's to gasoline and diesel cars and trucks, lowering the emission of harmful nitrogen oxides and particulate matter, while also continuing the current program's requirement on manufacturers to provide increasing numbers of "zero-emission vehicles" (which included EVs, plug-in hybrids, and fuel cell vehicles) to market.

Connecticut needs to adopt these more stringent vehicle emission standards to meet compelling air quality issues in the state. These regulations are essential and are fully within the authority of the Department of Energy and Environmental Protection (DEEP) to adopt and implement. Adoption of these standards will ensure more rapid reductions in polluting emissions from conventional vehicles, as well as ensuring that zero-emissions vehicles will be available for sale and use in our state and that our citizens will share in the benefits of reduced emissions and cleaner air.

We urge DEEP to act with all deliberate speed to ensure that Connecticut residents enjoy the full benefits of these incredibly important standards.

Connecticut's Adoption of California Motor Vehicle Emissions Standards is Authorized by and Consistent with Federal Law

California's Authority to Adopt Independent Emissions Standards

California's authority to adopt its own independent motor vehicle emissions standards is set forth in section 209 of the federal Clean Air Act (CAA). The federal Clean Air act provides for the waiver of the general federal preemption of state adoption or enforcement of motor vehicle emissions for any state that adopted motor vehicle emissions standards

prior to March 30, 1966.[1] This exemption, applicable only to California, was adopted in recognition of the state's early leadership in addressing serious air quality issues through its regulation of motor vehicle emissions, among other actions.[2]

Consistent with the CAA's recognition of California's expertise in this area, EPA has limited authority to deny California's request for a waiver.[3] The Environmental Protection Agency must grant the preemption waiver to California if the state has determined that "the State standards will be, in the aggregate, at least as protective of public health and welfare as applicable Federal standards." EPA may only deny the waiver if it finds that (1) California's determination was arbitrary and capricious, (2) the state doesn't need the state standard to meet compelling and extraordinary conditions, or (3) the state standards and enforcement procedures are inconsistent with the Clean Air Act's provisions regarding technological feasibility.[4] Given the strict limitations on denying a waiver, it is not surprising that EPA has never denied a waiver request.[5]

Connecticut's Authority to Adopt California's Emissions Standards

Connecticut's adoption of the California motor vehicle standards is expressly authorized by section 177 of the Clean Air Act, which provides that

> any State which has [national ambient air quality standard nonattainment] plan provisions approved under this part may adopt and enforce for any model year standards relating to control of emissions from new motor vehicles or new motor vehicle engines and take such other actions as are referred to in section 7543(a) of this title respecting such vehicles if—
> (1) such standards are identical to the California standards for which a waiver has been granted for such model year, and
> (2) California and such State adopt such standards at least two years before commencement of such model year (as determined by regulations of the Administrator).[6]

Similar to California, Connecticut needs to adopt more stringent vehicle emission standards to meet compelling and extraordinary conditions. Connecticut has consistently been designated as nonattainment of the national ambient air quality standards (NAAQS) for ozone.[7] Consistent with the framework set forth in the CAA, Connecticut has submitted and received approval from EPA for numerous iterations of its State Implementation Plan (SIP) to address the state's nonattainment status.[8]

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[1] 42 U.S.C. §7543.
[2] *See* California Air Resources Board, *History*, https://ww2.arb.ca.gov/about/history#:~:text=In%201966%20California%20established%20the,Air%20Resources%20Board%20was%20established.
[3] "In waiver decisions, EPA has thus recognized that congressional intent in creating a limited review of California waiver requests . . . was to ensure that the federal government did not second-guess the wisdom of state policy." 87 Fed. Reg. 14332, at 14342 (Mar. 14, 2022).
[4] 42 U.S.C. §7543 (b) (1).
[5]. The Trump administration mounted an unprecedented and Quixotic effort to withdraw a previously granted waiver, but this effort was terminated by the Biden administration. EPA-HQ-OAR-2021-0257, *California State Motor Vehicle Pollution Control Standards; Advanced Clean Car Program; Reconsideration of a Previous Withdrawal of a Waiver of Preemption; Notice of Decision*, 87 Fed. Reg. 14332 – 14379 (Mar. 14, 2022).
[6] 42 U.S.C. §7507.
[7] U.S. EPA, *Connecticut Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants* (current as of July 31, 2023), https://www3.epa.gov/airquality/greenbook/anayo_ct.html.
[8] U.S. EPA, *EPA Approved Regulations in the Connecticut SIP*, https://www.epa.gov/sips-ct/epa-approved-regulations-connecticut-sip.

As part of its nonattainment efforts, Connecticut has a long history of following the California emission standards. This includes adoption of California's Low Emission Vehicle (LEV) regulations beginning in 1994,[9] LEV II (2004),[10] and LEV III (2013),[11] including the relevant Zero Emissions Vehicle (ZEV) and greenhouse gas (GHG) components of such regulations.

Consistency with the full suite of California's motor vehicle emissions standards is necessary both to address Connecticut's own compelling and extraordinary conditions as well to comply with the CAA's prohibition on taking an action that would have the effect of creating a "third vehicle" standard,[12] and Connecticut's requirement to update the relevant regulations to maintain consistency with the California standards.[13]

Connecticut's Clean Vehicle Regulations Meet Federal and State Requirements

Motor vehicle standards that address greenhouse gas emissions as a regulated pollutant under the Clean Air Act and that support a shift to cleaner, more advanced technologies are within the scope of authority granted to California and the section 177 states, including Connecticut.[14] "The whole approach of the Clean Air Act is to force the development of new types of emission control technology where that is needed by compelling the industry to 'catch up' to some degree with the newly promulgated standard."[15]

As noted above, Connecticut satisfies the federal statutory criteria for adoption of the full suite of California emissions standards in that it faces significant air quality challenges and is in non-attainment for federal air quality standards, particularly for ground-level ozone.

The Connecticut General Assembly endorsed Connecticut's adoption of the Advanced Clean Cars and Low Emissions Vehicle programs (including necessary updates to remain in alignment with the California regulations) when it passed Public Act 04-84, which *requires* DEEP to adopt California's light-duty vehicle emissions standards and to update Connecticut's regulations as necessary to maintain consistency with the California standards.[16] Most recently, Public Act 22-25 expressly authorized DEEP to adopt California's medium-and-heavy duty vehicle standards.[17] The Connecticut General Assembly has had multiple opportunities to repeal the state's status as a section 177 state over the last several years (as the current regulations were being developed) and as has decidedly chosen not to so, further affirming the clear legislative intent to continue the state's leadership in addressing its air quality issues and improving public health through adoption of more stringent motor vehicle standards.

The Proposed Regulations are Feasible and Support Current Market Trends While Providing Additional Benefits for Customers

These regulations build on the requirements of the Advanced Clean Cars (ACC I) program, which has been successful in supporting the market transition to clean vehicles and ensuring that such vehicles are available to consumers who wish to purchase them. However, the ACC I regulations only apply to vehicles through model year 2025, so the current regulations are necessary to extend the program and ensure continued progress.

Existing Market Trends

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[9] RCSA § 22a-174-36.
[10] RCSA § 22a-174-36b.
[11] RCSA § 22a-174-36c.
[12] 42 U.S.C. § 7507.
[13] *See* Public Act No. 04-8, *An Act Concerning Clean Cars* (signed May 10, 2004); Public Act No. 22-25, *An Act Concerning The Connecticut Clean Air Act* (signed May 10, 2022).
[14] *See* Massachusetts v. EPA, 549 U.S. 497 (2007).
[15] 87 Fed. Reg. at 14342-14343.
[16] Public Act No. 04-8, *An Act Concerning Clean Cars* (signed May 10, 2004). It is worth noting that the bill passed by a vote of 143-1 in the House and 36-0 in the Senate.
[17] Sec. 15 of Public Act No. 22-25, *An Act Concerning the Connecticut Clean Air Act* (signed May 10, 2022).

In the instance case, the regulations align with where the industry is already headed and provide additional certainty with respect to the continued development of the EV market. Vehicle manufacturers have developed and released increasing numbers of both light duty and medium and heavy-duty electric vehicle models in recent years, and the EV market is experiencing exponential growth. According to the EIA, 14% of all car sales globally were EVs in 2022 (up from 9% in 2021 and less than 5% in 2020). In Europe, more than one in 5 cars sold was an EV in 2022 and Norway has achieved an 80% EV market share for new car sales. EV sales in the US increased 55% in 2022, reaching an annual market share of 8%,[18] with California reaching its goal of 21% EV sales two years ahead of schedule. In real numbers, the U.S. "is now the third largest EV market . . . the number of EVs on the road jumped from about 22,000 in 2011 to over 2 million in 2022."[19] In the first quarter of 2023, EV sales were up 60% relative to the same period last year.[20]

The number of zero-emission truck models has also continued to expand in 2022, with nearly 840 current and announced medium- and heavy-duty vehicle models in the Global Drive to Zero Emission Technology Inventory (ZETI) database.[21] Of commercially available bus and truck models in 2022 over 170 models were produced by North American manufacturers.[22]

Consumer Protection

While the market shift away from ICE vehicle to EVs is already well underway, Connecticut's proposed regulations provide additional consumer protection guarantees and incentives for manufacturers to provide low-cost vehicles, making EVs affordable for all customers. For example, the regulations require that all new vehicles delivered to the state be covered by certain ZEV assurance measures. These include minimum range durability requirements and enhanced battery warrant requirements.[23]

Affordability

Under the regulations, auto manufactures can receive extra program credit for providing discounted vehicles to community-based clean mobility programs and for bringing low-price EVs (not greater than $20,275 for a car or $26,670 for a light truck) to market.[24]

There are also existing federal and state financial incentives for the purchase of an electric vehicle. The Inflation Reduction Act (IRA) extends the federal $7,500 tax credit for the purchase of an EV through 2032. The IRA also established a $4,000 tax credit for used EVs (or 30% of the sales price, whichever is lower), and a new tax credit for commercial electric vehicles[25]. At the state level, Connecticut offers a cash incentive of $2,000 (with an additional $2,500 available for low-and-moderate income customers).

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[18] This figure is for the entire United States, including non-section 177 states.
[19] Sara Baldwin and Jack Conness, *Comparing the Cost to Travel: Electric vehicle Fill-Up Savings by State*, Energy Innovation Policy & Technology LLC, (Aug. 2023), https://energyinnovation.org/wp-content/uploads/2023/07/EV-Fill-Up-Savings-by-State.pdf.
[20] International Energy Agency, *Global EV Outlook 2023; Catching up with climate ambitions* (Apr. 2023), https://www.iea.org/reports/global-ev-outlook-2023
[21] International Energy Agency, *Global EV Outlook 2023; Trends in heavy-duty vehicles,* available at https://www.iea.org/reports/global-ev-outlook-2023/trends-in-electric-heavy-duty-vehicles.
[22] https://www.iea.org/reports/global-ev-outlook-2023/trends-in-electric-heavy-duty-vehicles.
[23] *See* The International Council on Clean Transportation, A*dvanced Clean Cars II: The next phase of California's Zero-Emission Vehicle and Low-Emission Vehicle regulations* 4-5 (Nov. 2022)
[23] *See* 87 Fed. Reg. 49 at 14364 -14366.
[24] *See* The International Council on Clean Transportation, A*dvanced Clean Cars II: The next phase of California's Zero-Emission Vehicle and Low-Emission Vehicle regulations* 5-6 (Nov. 2022)
[25] The commercial EV tax credit is $7,00 for vehicles under 14,000 lbs. GWV and up to $40,000 for larger vehicles.

At the same time, EVs cost less than conventional ICE vehicles to operate and maintain. A recent study has found that its cheaper to drive an EV than a gas-powered vehicle in every state in the U.S.[26] EVs also require far less maintenance than ICE vehicles due to fewer moving parts and avoiding the need for oil changes, etc. On average, maintenance costs for EVs are 40% lower than for their ICE counterparts.[27]

Domestic Manufacturing

The IRA also ties the federal tax credit to new requirements regarding the domestic manufacture and assembly of electric vehicle and batteries. One year after the IRA was passed, it has led to the creation of over 75,000 new jobs in the battery supply chain, with more than 190 new or expanded mineral, materials processing and manufacturing facilities, and resulted in over 80 new or expanded electric (EV) component or assembly plants in the United States.[28] In addition, the United States has seen growth in domestic battery recycling facilities,[29] and it is expected that battery recycling could meet up to 30% of nickel and 80% of cobalt usage in EVs by 2030.[30]

Finally, this growth in demand for EVs is being matched by investments in the charging infrastructure to support increased EV deployment. The Inflation Reduction Act provides a total of $7.5 Billion to building out the nation's EV charging network from 2022 to 2026.[31]

Adopting the Proposed Regulations will Result in Significant Environmental, Health and Economic Benefits for Connecticut

Adopting the proposed regulations is necessary for Connecticut to meet its clean air goals and individual greenhouse gas reduction obligations.[32] In Connecticut, the transportation sector accounts for 40% of Connecticut's greenhouse gas emissions,[33] and 66% of NOx emissions (a key component of ground-level ozone).[34] Cleaning up these emissions is particularly important for the health of low-and-moderate income populations living in our dense urban communities and

[26] Sara Baldwin and Jack Conness, *Comparing the Cost to Travel: Electric vehicle Fill-Up Savings by State*, Energy Innovation Policy & Technology LLC, (Aug. 2023), https://energyinnovation.org/wp-content/uploads/2023/07/EV-Fill-Up-Savings-by-State.pdf.
[27] Jim Groveland, "By The Numbers: What It Costs To Maintain An Electric Vehicle," Forbes (Oct. 6, 2022), https://www.forbes.com/sites/jimgorzelany/2022/10/06/by-the-numbers-what-it-costs-to-maintain-an-electric-vehicle/?sh=5987807564d3.
[28] U.S. Dept. of Energy, *The Inflation Reduction Act in Its First Year* (Aug. 15, 2023), https://www.energy.gov/articles/inflation-reduction-act-its-first-year; U.S. Dept. of Energy, *Battery Supply Chain Investments* (July 20, 2023), Investments in American-Made Energy | Department of Energy.
[29] Charles Morris, "IRA incentives set off battery recycling gold rush," Charged (July 25, 203), https://chargedevs.com/newswire/ira-incentives-set-off-battery-recycling-gold-rush/#:~:text=The%20voluminous%20Inflation%20Reduction%20Act,for%20the%20IRA's%20purchase%20incentives.
[30] Bruno Venditti and Miranda Smith, *Visualizing America's Electric Vehicle Future* (Jan. 20, 2022), https://www.visualcapitalist.com/sp/visualizing-americas-electric-vehicle-future/.
[31] White House, "Biden-Harris Administration Announces New Standards and Major Progress for a Made-in-America National Network of Electric Vehicle Chargers," (Feb. 15, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/02/15/fact-sheet-biden-harris-administration-announces-new-standards-and-major-progress-for-a-made-in-america-national-network-of-electric-vehicle-chargers/.
[32] Connecticut has committed to reducing its greenhouse gas emissions 45% by 2030 and 80% by 2050. Conn. Gen. Stat. § Sec. 22a-200a. Additionally, Connecticut has some of the worst air quality in the country according to the most recent report by the American Lung Association, https://www.lung.org/media/press-releases/state-of-the-air-connecticut.
[33] CT DEEP, *1990-2021Connecticut GHG Emission Inventory* 11 (2023).
[34] CT DEEP, *An Assessment of Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emissions Standards* 7 (2022), MHD_Whitepaper_030822.pdf (ct.gov).

along the state's major transportation corridors.[35] The Asthma and Allergy Foundation of America has ranked New Haven and Hartford as among the worst cities in the country for asthma (#5 and #17, respectively).[36]

Multiple analyses of the benefits of adopting both the Advanced Clean Cars II (ACC II) and Advanced Clean Truck (ACT) rule have been conducted, all demonstrating substantial benefits over a business as usual scenario.

Adopting ACC II would reduce total NOx and PM2.5 emissions in Connecticut by 580 and 39 tons/year, respectively.[37] A recent report by the American Lung Association found that if all new car sales were EVs by 2035, Connecticut would realize $11.5 billion in cumulative health benefits between 2020-2050, avoid 1,060 premature deaths, 22,900 asthma attacks, and 120,000 lost work days.[38] A study conducted by the international consulting firm EBP found that the economic and societal benefits of adopting the ACC II standards are "compelling and significant." Among the anticipated economic benefits are:

- $25.7 billion of value added to Connecticut's GDP
- $40.1 billion increase in net business income
- 128,200 net new job-years in CT[39]

In addition to the economic and health benefits, adoption of ACC II would result in the avoidance of 137 million metric tons of CO_2 emissions, the equivalent of planting 3.5 billion trees.[40] The anticipated reduction in emissions form criteria and climate pollutants is expected to deliver improvements across twenty-four personal and societal metrics including human health, productivity, social equity, food and water security, biodiversity, and mitigation of natural disasters such as wildfires and flooding.[41]

The Advanced Clean Truck (ACT) standards will result in annual reductions of ground-level ozone pollutants of between 2,600 to 3,300 tons a year, and cumulative reductions in greenhouse gas emissions of nearly 1.5 million metric tons.[42] The Department of Energy and Environmental Protection has estimated that these standards "could save Connecticut residents more than $271 million in healthcare costs by 2040."[43] By 2050, cumulative savings in healthcare costs are estimated at $413 million.[44]

Connecticut Climate Impacts

Connecticut, like California, is particularly impacted by climate change. Among the climate-related impacts that Connecticut faces are:

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[35] *See* California Air Resources Board, "California takes bold step to reduce truck pollution: First-of-its-kind requirement for electric trucks will help communities hardest hit by air pollution" (June 25, 2020) https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution.

[36] Asthma and Allergy Foundation of America, *Asthma Capitals 2021: The Most Challenging Places to Live with Asthma* at 6 (May 2021), available at https://www.aafa.org/media/3040/aafa-2021-asthma-capitals-report.pdf.

[37] International Council on Clean Transportation, Benefits of Adopting California's Advanced Clean Cars II (ACC II) Standards in Connecticut (May 2023), ct-acc-ii-benefits-fs-may23.pdf (theicct.org).

[38] American Lung Association, Driving to Cleaner Air: Health Benefits of Zero-Emission Cars and Electricity (June 2023), Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity (lung.org).

[39] EBP, *Connecticut Electric Vehicle Policy Impacts Study* 4-5 (Apr. 2023), Connecticut Electric Vehicle Policy Impact Study (savethesound.org).

[40] EBP, *Connecticut Electric Vehicle Policy Impacts Study* 4-5.

[41] EBP, *Connecticut Electric Vehicle Policy Impacts Study* 38-40.

[42] CT DEEP, *An Assessment of Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emissions Standards* 16 (2022).

[43] CT DEEP, *An Assessment of the Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emission Standards* 17 (2022).

[44] CT DEEP, *An Assessment of the Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emission Standards* 17 (2022) Other estimates are as high as $1.4 billion. *Id*. at 18.

- **Sea Level Rise:** 91% of CT's population live or work in communities prone to flooding. CT has experienced a six-inch rise in sea level in the last 50 years (higher than current global rates), and sea level is expected to rise an additional 1.5 feet by 2050.[45]
- **Extreme Heat Days:** Connecticut has some of the worst air quality in the country, with Hartford, Bridgeport, and New Haven among the top cities where it is most challenging to live with asthma.[46] Temperature in CT is rising faster than the global average[47]—impacting the health of children, the elderly, and those with respiratory issues such as asthma.
- **Increasing Storms:** Over the last decade, storms have left more than 2 million CT customers without power and caused more than $3 billion in statewide damage.[48]

Recognizing the specific state-level adverse impacts that climate change pose for Connecticut, the state has adopted greenhouse gas reduction targets, with a goal of reducing such emissions 45% by 2030 and 80% by 2050. It is critical to reach these targets in order to protect our environment, public health, and economy form the worst consequences that a changing climate threatens. The U.S. EPA has determined that the nexus between GHG emissions regulation and criteria pollutant emissions satisfies the necessary showing of compelling circumstances to adopt more stringent vehicle emissions standards that address climate-related emissions.[49]

Connecticut is not Acting Alone

In proposing to adopt these updated regulations, Connecticut joins a growing number of states around the country that have already adopted these latest regulations or in the process of doing so. Currently, 17 states, including Connecticut, follow California's more stringent emissions standards pursuant to the federal grant of authority under the Clean Air Act. This group of states accounts for more than 40% of new vehicle sales.[50] Seven states have already adopted the updated ACCII standards (California, Washington, Oregon, Massachusetts, New York, Virginia, and Vermont) and five more states have begun the process of adopting these standards.[51] Eight states have already adopted the ACT rule: (California, Oregon, Washington, Massachusetts, Vermont, New York, New Jersey, and Colorado), while two more are in the process of adopting the requirement.[52]

Acting in concert with our neighboring jurisdictions multiplies the benefits that can be derived from the proposed regulatory requirements. This is particularly true in the case of climate impacts, as the states working to adopt these standards represent a significant portion of the population of the United States, as well as of the motor vehicle market.

Conclusion

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[45] CT DEEP, *Connecticut: Our Changing Climate* 6 (Aug. 2020), CT-Changing-Climate-Booklet.pdf.
[46] Asthma and Allergy Foundation, *Asthma Capitals 2022* at 9 (2022), AAFA 2022 Asthma Capitals Report September 2022.
[47] UMASS Amherst, *How will global warming of 2°C affect Connecticut?: Observed and projected changes in climate and their impacts* (Apr. 26, 2016), https://www.geo.umass.edu/climate/stateClimateReports/CT_ClimateReport_CSRC.pdf.
[48] *See* Ten Year Anniversary of Super Storm Sandy (UCONN Connecticut Institute for Resilience & Climate Adaptation (CIRCA) (Nov. 7, 2022); A decade after Superstorm Sandy, one resident recalls costs to Connecticut's coast (CT Public Radio Oct. 27, 2022); One Year Later: The Lasting Impacts of Tropical Storm Isaias (NBC CT Aug. 4, 2021); Tropical Storm Irene 1 year later: Greater New Haven towns rebuild, but pain lingers (NH Register Aug. 25, 2012); 2011 Halloween nor'easter (Wikipedia) ("At a November 1 press conference, Governor Malloy estimated that damages in Connecticut would exceed $3 billion. Two days later, close to 700,000 homes and businesses remained without power. A week after the storm, almost 150,000 customers of the state's two utilities had not yet had power restored.").
[49] *See* 87 Fed. Reg. at 14364 -14366.
[50] California Air Resources Board, *States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act* (May 13, 2022), https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177_states_05132022_NADA_sales_r2_ac.pdf.
[51] CalStart & Ceres "Companies applaud as five states take action to bring more clean cars and trucks to their roads" (2023), https://calstart.org/companies-applaud-five-states-for-acc-act-rules-action/#:~:text=If%20all%20five%20states%20finalize,of%20adopting%20the%20ACCII%20rule.
[52] *Id.*

The standards are essential to meeting the needs of Connecticut in addressing pressing air quality, health, and environmental issues facing the state. By adopting these standards Connecticut is following the path set out in the federal Clean Air Act, as well as the express will of the General Assembly.

We urge DEEP to finalize the regulations with all deliberate speed to ensure that Connecticut's residents enjoy the full benefits of these incredibly important standards when they go into effect.

Thank you for the opportunity to provide these comments.

Respectfully submitted,

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CONNECTICUT ELECTRIC VEHICLE POLICY IMPACT STUDY

2023 REPORT PREPARED FOR SAVE THE SOUND

BASED ON DATA AVAILABLE IN 2022

EBP

Contents

Executive Summary

This report examines expected economic impacts from transitioning Connecticut's motor vehicle markets from fossil fueled Internal Combustion Engine (ICE) vehicles to a fleet of alternatively fueled vehicles, such as electric vehicles. This transition will achieve substantial reductions in greenhouse gas and criteria pollutant emissions, producing significant public health benefits and an energy-efficient economy. The Connecticut transportation transformation will result in changes in the state's economy, providing opportunities for economic development while adjusting the make-up of jobs and professions that serve the transportation industry. The analysis examines the market from several perspectives to provide Connecticut stakeholders with clearer expectations of how the economy will change as a result of the transition to clean electric vehicles, and what the changes will mean for Connecticut.

Connecticut is not undertaking this transformation alone. The state is one of a group of 18 states, including California, developing and following complementary pathways to achieve greatly reduced vehicle emissions. California's development of, and investment in, emission-reduction policies and protocols set the overall direction, with early participation by Connecticut, Massachusetts, and New York, among others. Each of Connecticut's neighboring states, Rhode Island, Massachusetts, New York and other states in New England, the Mid-Atlantic, and other regions are following these pathways, structuring them to best serve their state's particular environment and needs within common frameworks. To assist readers, the report shows how four states are working to integrate Zero-Emission Vehicles (ZEVs) and the infrastructure needed to support a transition to Battery Electric Vehicles (BEVs), Plug-In Hybrid Electric Vehicles (PHEVs), and Fuel Cell Electric Vehicles (FCEVs).

Background

California has recently updated its motor vehicle emissions regulations with the adoption of the Advanced Clean Cars II (ACC II) regulations. These regulations require that an increasing percentage of light-duty vehicles sold in the state be zero-emission vehicles (ZEVs), with a goal that by 2035 all new passenger cars, trucks and SUVs sold in the state will be zero emissions.[1, 2]

ACC II includes compliance flexibilities that make it easier for auto manufacturers to meet the state's goals. These include credits for complying before ACC II takes effect; complying with ACC I; and expanding access to ZEVs in low-income communities.[3] The flexibilities also include the

[1] Advanced Clean Cars II, California Air Resources Board, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii.
[2] The California Air Resources Board approved the Advanced Clean Cars II Regulations, including the Zero Emission Vehicle Standards for 2026 and Subsequent Model Year Passenger Cars and Light-Duty Trucks, on August 25, 2022.
[3] Kathy Harris, *Clean Car Rules: What they Mean for States*, NRDC (October 5, 2022), https://www.nrdc.org/experts/kathy-harris/clean-car-rules-what-they-mean-states.

ability to transfer credits from states with high ZEV sales to states with lower sales, as well as an allowance for fuel cell vehicles.

The proposed ACC II policy is intended to drive the sales of ZEVs while reducing smog-forming emissions from new internal combustion engine (ICE) vehicles.[4] These standards are intended to reduce pollution from conventional vehicles, improve public health, and accelerate the transition to zero-emission vehicles, which will have the added benefit of reducing the total cost of ownership for passenger cars and light trucks, saving drivers money and further supporting consumer adoption of electric vehicles.[5] Connecticut is one of 17 states that have opted to follow California's vehicle emissions regime, rather than the less stringent federal standards. As such, Connecticut now has the opportunity to join with California, Massachusetts, New York, and other states in adopting the ACC II standards.

Connecticut's transportation sector is the largest contributor of greenhouse gases (GHG) in the state, accounting for 37.4 percent of total state emissions, approximately twice any other sector.[6] Connecticut also suffers from some of the worst air quality in the country, with New Haven and Hartford in the top 20 of U.S. cities where it is most challenging to live with asthma.[7] Mobile source pollutants such as nitrogen oxides (NO_x) contribute to smog formation and poor air quality, exacerbating other chronic respiratory problems such as Chronic Obstructive Pulmonary Disease (COPD) and other lung diseases.[8]

The Governor's Council on Climate change (GC3) and the Department of Energy & Environmental Protection (DEEP) have identified transportation electrification as one of the primary strategies to improve air quality and to achieve the state's economy-wide greenhouse gas (GHG) reduction targets, as required by the Global Warming Solutions Act (GWSA), of 45 percent below 2001 levels by 2030, and 80 percent by 2050.[9] Adoption of ACC II is critical to increasing ZEV penetration rates to help meet Connecticut's public health and climate goals and state and federal air quality standards. There are 25,444 EVs registered in Connecticut as of July 1, 2022,[10] which is 5.1 percent of the state goal of 500,000 ZEVs by 2030.[11] The ZEV market share of Connecticut new light-duty vehicle sales for the first two Quarters of 2022 was 6.83 percent, up from 2.36 percent

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[4] In addition to the ZEV standards, the ACC II regulations update and revise vehicle engine emissions standards for NMOG and NO_x, CO, and particulate matter (PM). Final Regulation Order: Adoption of new Section 1961.4, Title 13, California Code of Regulations. Connecticut may adopt California's engine and motor vehicle emission standards under Section 177 of the Clean Air Act, 42 U.S.C. § 7507.

[5] California Air Resources Board Public Hearing to Consider the Proposed Advanced Clean Cars II Regulations (April 2022), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/isor.pdf.

[6] Connecticut Department of Energy and Environmental Protection, *2018 Greenhouse Gas Emissions Inventory* (2021), https://portal.ct.gov/-/media/DEEP/climatechange/GHG_Emissions_Inventory_2018.pdf.

[7] Asthma and Allergy Foundation of America, *Asthma Capitals 2021*, https://www.aafa.org/media/3040/aafa-2021-asthma-capitals-report.pdf.

[8] Connecticut Department of Energy and Environmental Protection, *Electric Vehicle Roadmap for Connecticut* (2020), https://www.dpuc.state.ct.us/DEEPEnergy.nsf/c6c6d525f7cdd1168525797d0047c5bf/f7ed4932eec438d0852585520001c81b/$FILE/EV%20Roadmap%20for%20Connecticut.pdf.

[9] Connecticut General Statute § 22a-200a.

[10] Connecticut Department of Energy and Environmental Protection, *EV Registration Fact Sheet*, https://portal.ct.gov/-/media/DEEP/air/mobile/CHEAPR/2022-07-01---Expanded-EV-Reg-Fact-Sheet.pdf.

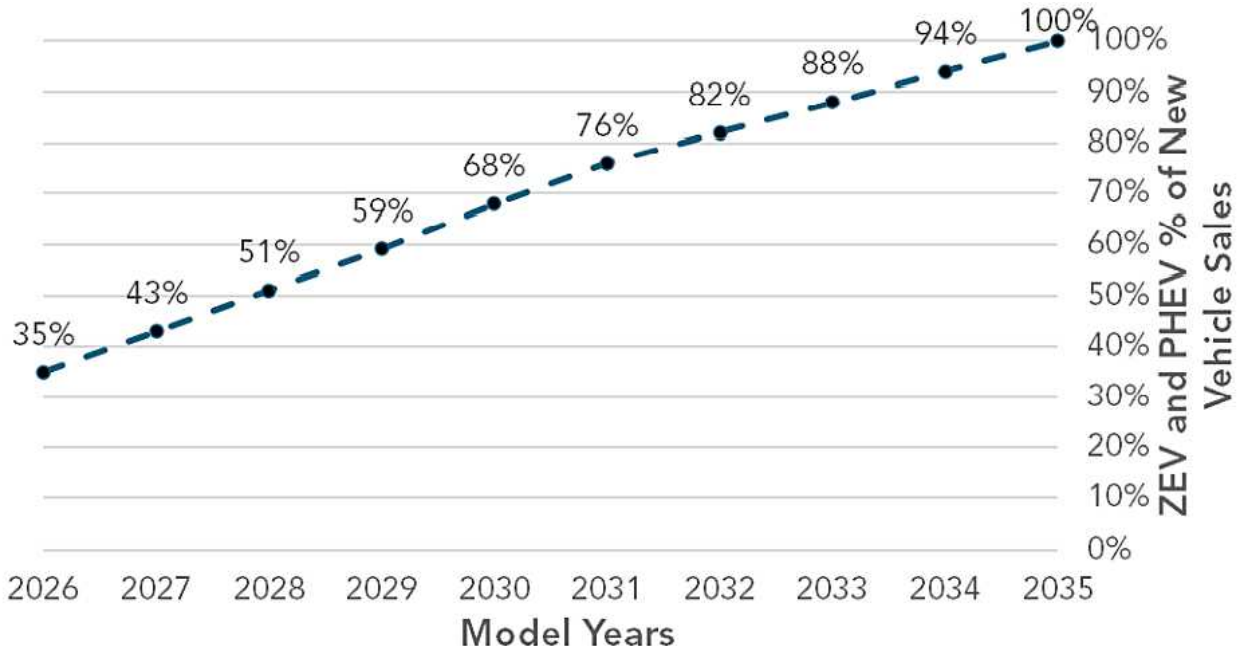
[11] Connecticut Department of Energy and Environmental Protection, *Electric Vehicle Roadmap for Connecticut*, (2020).

in 2020.[12] The Connecticut Hydrogen Electric Automobile Purchase Rebate (CHEAPR) program has recently had its annual funding increased from $3 million to $8 million annually, which will help to support achieving the state's ZEV goal.[13] Beginning in 2023, an additional estimated $5 million from the Regional Greenhouse Gas Initiative (RGGI), will be dedicated to the CHEAPR program.[14]

ZEVs provide multiple benefits to Connecticut drivers, including lower maintenance and fuel costs, as well as broader benefits to the state, including net positive economic impacts and numerous societal co-benefits of avoided emissions.

The ACC II policy will significantly reduce emissions from light-duty passenger cars, trucks, and SUVs. The ACC II policy requires ZEVs to constitute an increasing percentage of new car sales, starting with the 2026 model year at 35 percent, progressing to 68 percent in 2030 and to 100 percent in 2035, as shown in Figure 1 below.

Figure 1. Proposed Annual ZEV Sales Attainment



Source: California's Proposed Advanced Clean Cars II Regulations.

Under California's complementary Advanced Clean Truck (ACT) rule, starting in 2024, ZEV sales goals for Medium and Heavy-Duty trucks are set to ramp up to 30 to 50 percent by 2030, depending upon the specific vehicle weight class, and between 40 and 75 percent by 2035. It is

[12] Alliance for Automotive Innovation quarterly reports, https://www.autosinnovate.org/posts/papers-reports/Get%20Connected%20EV%20Quarterly%20Report%20Q4.pdf.
[13] Public Act 22-25, *An Act Concerning The Connecticut Clean Air Act* (May 10, 2022), https://www.cga.ct.gov/2022/act/pa/pdf/2022PA-00025-R00SB-00004-PA.pdf.
[14] *Id*.

likely at this point that electricity will be the fuel of choice for most medium and many heavy-duty trucks that are used for local or short haul trips. Hydrogen appears to be the better solution for long haul trips, but this is highly dependent on the fuel cost of green hydrogen and the real-world total cost of ownership and operation, considering actual costs for several types of battery electric and fuel cell vehicles in multiple usage patterns, such as long-haul versus local uses.

Summary of Findings

This study provides an objective analysis of future impacts for Connecticut's economy, as well as broader societal benefits to be expected with the transition to electric vehicles. The primary conclusion from the study is that economic impacts and societal benefits are compelling and significant, and that failure to adopt the policy would jeopardize achieving Connecticut's public health, clean air, and emission reduction goals.

Connecticut has a major opportunity to benefit economically from a transition to EVs. The proposed policy will support increased EV adoption, which will generate positive economic impacts for individuals, households, manufacturers, energy suppliers and various equipment maintenance services throughout the state. Connecticut can also grow its economy beyond direct effects of EVs by capitalizing on new economic development opportunities around EV-related technologies such as energy storage, electrical components manufacturing, and charging station design and manufacturing.

Estimated net economic impacts, benefits and avoided emission costs attributable to adopting ACC II are in Table 1. Economic impacts represent changes in the flow of money in the Connecticut economy, whereas societal benefits have economic value in terms of avoided costs.

Table 1. Estimated Net Economic Impacts, Benefits and Avoided Emission Costs from Connecticut's Light-Duty Vehicles, 2022-2050 (29-Year Total in Billions of Constant 2021 Dollars)

Economic Impacts and Societal Benefits from Connecticut 100% EV Sales Policy	Value of Benefits and Impacts (Billions)
Added Net Business Income (Economic Impact)	$40.1
Value Added (GDP) Growth in Connecticut (Economic Impact)	$25.7
Value of Criteria Pollutant Emission Reductions (Societal Benefits - Local)	$4.4
Value of Carbon Emission Reductions (Societal Benefits – Global)	$27.1

Table 2 highlights key findings and conclusions that call out the economic impacts and societal benefits of the 100 percent EV sales policy between 2022 and 2050.

Table 2. Key Conclusions, 29-Year Effect from 2022-2050 (Billions of Constant 2021 Dollars)

Key Conclusions
$40 billion in net business income (economic impact).
$26 billion in net value added or GDP (economic impact).
128,200 net new job-years, representing about 4,400 more jobs than would otherwise exist each year.
$4 billion in value of criterial pollutant emission reductions (societal benefits - local).
$27 billion in value of carbon emission reductions (societal benefits - global).
$42 billion in gross vehicle fuel cost savings.
$15 billion in gross vehicle operating and maintenance cost savings.
Carbon emission reductions of 137 million metric tons CO_2.
Carbon emission reduction equivalent of planting 3.5 billion trees.
Improved air quality from pollution emission reductions of NO_x (68,681 metric tons), SO_2 (796 metric tons), PM2.5 (3,418 metric tons), and VOCs (81,080 metric tons)
The policy will unlock new opportunities for economic development around EV-related technologies.
The policy will ensure Connecticut stays economically competitive by capturing market share in EV-related industries sooner than other states.
Failure to adopt the ACC II policy would jeopardize achieving Connecticut's public health, clean air, and emission reduction goals.
Due to the EV content provisions of the Inflation Reduction Act, full implementation is likely to be slowed, making Connecticut's state-level incentives even more important in the current and near-future EV transition.

Note: The net impact accounts for losses in income, whereas gross impacts account for gains only.

This report consists of seven sections.

- **Introduction**. Highlights Connecticut's work as one of the original ZEV sponsors. It then describes EBP's approach and methods to develop an objective analysis tailored to the specific circumstances in Connecticut, including the primary economic drivers, impacts on workers, income, and the overall economy.
- **Interviews.** To help in guiding the economic analysis EBP interviewed eleven leading professionals from a variety of perspectives including, business, manufacturing, economic development, environmental policy, and three state governments.
- **Background Research.** To provide a full context, EBP researched a number of critical factors, their history and relevant technology and economic concerns, including a comparison of key EV and charging infrastructure goals, programs, and achievements.

Discussion of the Inflation Reduction Act and its likely impact on ZEV adoption in Connecticut, and a discussion of the applicability of hydrogen fuel-cell vehicles (FCEVs) in the coming decade, is also included.

- **Economic Analysis.** EBP conducted an economic analysis, reporting on key metrics, including energy dollars kept in state, business growth and development, long term cost savings to residences and businesses, broader job and income growth within Connecticut and tax revenue impacts for state and local government, resulting from the analysis findings within the overall topics of electric vehicle forecast, economic impacts, economic development opportunities, other opportunities, and costs of inaction.
- **Economic Value of Societal Benefits.** EBP conducted an analysis of carbon and criteria pollutant emission reductions, societal benefits, and monetization of the societal benefits of avoided emissions.
- **Medium and Heavy-Duty Trucks.** Examines Connecticut's ZEV policy determinations and actions regarding medium and heavy-duty trucking and then reports on a 2022 study by the National Renewable Energy Laboratory that analyzed economic considerations of vehicles by type, size, uses and miles traveled to estimate the optimal fuels for each case studied.
- **Key Conclusions.** Observations and conclusions from the qualitative and quantitative report results.

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Introduction

Connecticut has a history of leading on clean transportation, as one of the original ZEV state members, and home to the nation's first point-of-sale EV rebate program, the Connecticut Hydrogen and Electric Automobile Purchase Rebate program (CHEAPR). The state also has the benefit of a robust and active EV stakeholder coalition, the Connecticut EV Coalition, a group of environmental organizations and businesses that work together to advance policies that will build out electric vehicle infrastructure and put more electric vehicles on the road in Connecticut to achieve economic, health, and climate benefits.[15]

Save the Sound, convener of the Connecticut EV Coalition, has directed EBP to conduct this economic impact and societal benefits study to provide an objective analysis of future impacts and benefits for the Connecticut economy, as well as the broader societal benefits to be expected with the adoption of the 100 percent EV sales policy.

Approach

The study involved five primary components: 1) Stakeholder interviews, 2) Background research, 3) Economic analysis and modeling, 4) Societal benefits analysis and modeling, and 5) Development of key messaging.

The EBP team conducted nine interviews with key Connecticut EV and economic development stakeholders to ascertain the most important issues to stakeholders and obtain qualitative insights from stakeholders in various parts of the Connecticut EV ecosystem. Background research was performed to help set the stage for the economic impact and societal benefits analysis, including a comparison of leading state's decarbonization and EV transition plans, auto manufacturer's plans for electrifying their product lines, an examination of the recently enacted federal Inflation Reduction Act (IRA), and a brief look at hydrogen fuel cells.

The economic analysis began with development of alternative EV adoption forecasts for Connecticut, representing scenarios with and without the ACC II policy in place. A statewide economic model was utilized to assess the magnitude of direct effects on changes in household and business revenues and expenditures, and broader impacts on income, supply chains, business investment and consumer spending In Connecticut. The modeling incorporated insights from key stakeholder interviews regarding Connecticut's economic development and energy development opportunities and expectations.

The examination of the economic value of societal benefits was based on the EV forecasts and accepted emission factors for five key pollutants: carbon dioxide (CO_2), particulate matter (PM2.5), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and volatile organic compounds (VOCs).

[15] Connecticut Electric Vehicle Coalition, https://www.savethesound.org/what-we-do/climate-resiliency/cleaner-transportation/connecticut-electric-vehicle-coalition/.

Following a qualitative discussion of the individual and societal benefits of emission reductions, the report presents a monetization of the societal benefits using a social cost of carbon (SCC) approach.

The brief section on medium and heavy-duty trucks is followed by the concluding section that highlights the total value of economic impacts and societal benefits, and key conclusions that highlight the benefits that will accrue to the State of Connecticut and its residents by adopting the ACC II EV policy.

Interviews

EBP interviewed several knowledgeable Connecticut stakeholders from a variety of perspectives, including governmental agencies covering two states and a regional planning organization, EV advocates, and the largest Connecticut electric and gas utility, who have been in the forefront of the EV transition. They also included officials of statewide economic development and technology development agencies. The qualitative data developed from interviews guided the project research and economic analysis work, ensuring the project outputs are on-target.

Interview Topics

- Goals for EV adoption, factors working for and against reaching goals
- Primary policy and regulation issues, including coordination among state government players and programs
- Effective messages that will move the public and stakeholders to advance EV transition
- Equity issues in EV purchase and charging availability
- Useful studies and other references

Table 3 shows the list of interviewees.

Table 3. List of Interviewees

Name	Affiliation
Kevin Boughan, Brian Morrissey	Eversource
Ted Fisher	Director of Business Development, AdvanceCT
Eric Friedman	Massachusetts Department of Energy Resources
Jeremy Hunt	Northeast States for Coordinated Air Use Management (NESCAUM)
Barry Kresch	Connecticut EV Coalition
Paul Lavoie	Chief Manufacturing Officer, State of Connecticut (DECD)
Joel M. Rinebold	Director of Energy, Connecticut Center for Advanced Technology
Adam Ruder	New York State Energy Research & Development Authority (NYSERDA)
Rudy Stark, Eric Shrago	Connecticut Green Bank

Interview and Related Insights

EBP interviewed 11 knowledgeable individuals to assist in guiding the economic analysis, and also explored several of the identified issues such as the attraction of EVs for consumers, concerns about vehicle charging and range, high purchase costs compared to ICE vehicles, as well as early trends of fleet owner adoption.

Consumers want to purchase EVs. In early 2022, Consumer Reports interviewed 8,000 consumers in a national representative survey. They found high awareness of EVs, varying by demographic groups, including perceptions by 70 percent that EVs are an environmental issue, 31 percent indicating an interest in buying or leasing EVs, and 14 percent declaring they would definitely buy or lease an EV as their next car. Consumers cited the advantages of fueling with electricity as opposed to gasoline, expected fewer repairs, and were more likely to purchase an EV if they had driven or ridden in one. Concerns were expressed about range, charging, and high purchase costs, similar to the results of other surveys.[16]

Status of EV adoption. States are adopting goals to increase the deployment of electric vehicles, ultimately looking to reach 100 percent of new car sales. Actual sales have lagged expectations but are on the rise since 2021, against a backdrop of recent and on-going barriers, including the lingering impact of the COVID 19 pandemic, supply chain delays and disruptions, especially in microprocessors but affecting other key materials as well, leading to fewer available EVs. EV sales have increased largely in the higher priced vehicle segment. Two commenters noted that few potential EV buyers have the opportunity to test drive EVs because of scarcity of accessible cars at dealers, as well as concerns about insurance at community events. One commenter also believes there is too much emphasis in EV advertising on vehicle range since most daily usage of light-duty vehicles is short enough in mileage and duration to be satisfied by any EV currently on the market, and most earlier models that had much shorter range.

Despite the barriers, EV market penetration has increased beyond 5 percent in Connecticut and other leading states in the region. This milestone is important, say market observers such as Bloomberg, because sales beyond 5 percent of the total vehicle market means that EV buyers are no longer just early adopters.[17] Bloomberg assumes the EV market penetration curve will be similar to other significant consumer goods, indicating that the rate of EV market penetration will increase dramatically from this point. Market penetration will be further spurred by the broadening and deepening of incentives under the bipartisan Infrastructure Investment and Jobs Act (IIJA)[18] that will bring approximately $52 million to Connecticut for EV infrastructure investment, and the just passed federal Inflation Reduction Act (IRA) of 2022 which will provide

[16] Consumer Reports, *BEV and LCF Survey* (February 2022), https://article.images.consumerreports.org/prod/content/dam/surveys/Consumer_Reports_BEV%20AND%20LCF%20SURVEY_18_FEBRUARY_2022.

[17] Tom Randall, *U.S. Crosses Electric Car Tipping Point for Mass Adoption*, Bloomberg (July 9, 2022), https://www.bloomberg.com/news/articles/2022-07-09/us-electric-car-sales-reach-key-milestone?leadSource=uverify%20wall.

[18] https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf.

further resources. The IRA also adjusts the incentive structure to include a variety of direct incentives that can be transferred to dealers, rather than limiting federal incentives to tax incentives only, which should help to reduce the initial purchase price barrier.

Commercial fleet adoption. Commercial fleets may be adopting EVs much more quickly than initially estimated. A 2021 article notes 21 companies switching to electric fleets, including corporations such as Amazon, Comcast, Fed Ex, Hertz, Ikea, and Waste Management,[19] both because of environmental concerns and total costs of ownership. Figure 2 on page 12 graphically describes the total cost of ownership for both consumer and common delivery trucks, showing increasing favorability over time as technological and other factors such as reduced costs of maintenance and fuel come into effect.

Affordability. The EV market is rapidly evolving. Studies such as the 2021 Argonne National Laboratory Cost of Ownership study[20] demonstrate that over time levelized total costs of EV purchase, taxes, insurance, operation, and maintenance will become steadily less than ICE vehicles. However, the first cost of EVs is currently significantly higher than comparable ICE vehicles, constituting a substantial barrier for middle- and lower-income consumers. Without incentives in the form of federal tax credits, state rebates, and other incentives for some years to come, the EV market would not transform at the needed pace and a major means of reducing carbon emissions would be compromised. State initiatives like the CHEAPR program[21] are a vital element to moving EV markets beyond the current national new vehicle market share of six percent.[22]

Incentive programs need to be regularly evaluated to ensure they are effective in stimulating the target markets and are cost-effective. A study by the Commonwealth of Massachusetts[23] indicates that EV incentives are cost effective, but that there are free riders among the higher priced vehicle purchases. Some adjustments to incentives and additional mechanisms to attract medium- and lower-income consumers may be in order. Inclusion of used EVs in incentive programs may be an important aspect of broadening the market. Connecticut has recently increased and broadened incentives under the CHEAPR program to include increased incentives for medium- and lower-income customers, including for used vehicles. Other state programs, such as Massachusetts' MOR-EV program, are also considering similar incentive adjustments. At the national level, the Inflation Reduction Act has established federal incentives for the purchase of used vehicles for the first time, which should further help to expand access to EVs for lower- and middle-income customers.

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[19] Christine Lellis, *These 21 Companies Are Switching to Electric Vehicle Fleets*, Perillon.com (October 26, 2021), https://www.perillon.com/blog/21-companies-switching-to-electric-vehicle-fleets.

[20] Argonne National Lab, *Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains* (April 2021), https://publications.anl.gov/anlpubs/2021/05/167399.pdf.

[21] https://portal.ct.gov/DEEP/Air/Mobile-Sources/CHEAPR/CHEAPR---Home.

[22] Cox Automotive Inc., *EV Sales Hit New Record in Q2 2022* (July 13, 2022), https://www.coxautoinc.com/market-insights/ev-sales-hit-new-record-in-q2-2022/.

[23] Massachusetts Department of Energy Resources, *MOR-EV Cost-Effectiveness Study & Next Phase of Program*, (April 15, 2022), https://www.mass.gov/doc/zev-commission-april-15-2022-mor-ev-cost-effectiveness-study-next-phase-of-program/download.

Effective Messages. Interviewees for this analysis raised concerns that among consumers many potential EV customers are not knowledgeable about EVs and do not fully understand the financial benefits of available tax and rebate incentives. Consumers see high prices that look unaffordable. They are also concerned about vehicle range and the availability of charging stations when they take long drives.

The U.S. Department of Energy information Administration reports that 60 percent of all car trips were less than six miles, with daily mileage estimates ranging from 35-41 miles per day.[24] Based on these statistics, some interviewees believe the range concerns are unwarranted for most of daily driving. However, consumers want vehicles that can satisfy all of their driving needs.

PHEV's currently can drive all-electric for 20-55 miles on a full charge, satisfying most daily driving needs in all-electric mode.[25] Auto makers emphasize that PHEVs actual total range can be 500 miles or more, with the combination of electric and ICE driving, which can reduce consumers' range anxiety. Additionally, even a relatively inexpensive fully electric EV such as the Chevy Bolt has a range in excess of 200 miles on a single charge.[26] As BEV range increases and fast charging infrastructure grows, range anxiety should decrease.

EV's that currently dominate the market don't look affordable to many consumers, a circumstance that the California ZEV regulations look to address by providing additional compliance credits to manufactures that offer lower-priced ZEVs for sale. The first-cost barrier is real and not just for lower income consumers. Emphasizing total cost of ownership is good economic reasoning but messaging that explains the real package costs of EV purchases or leases when combined with available incentives needs to be improved.

There are also concerns about public charging availability and reliability. Most EVs are currently charged at home or at work.[27] However, while the number of public charging stations is growing rapidly, their reliability is a matter of concern. J.D. Power conducts quarterly surveys on public charging. They find that, while consumers like and understand the EV charging process and are comfortable with it, there is a lot of concern about the reliability of public charging equipment in place. According to J.D. Power, "charging station availability is a top barrier to the greater adoption of electric vehicles (EVs) as perceived by U.S. consumers today."[28] Morning Consult, a decision intelligence group, suggests the following based on their market research.

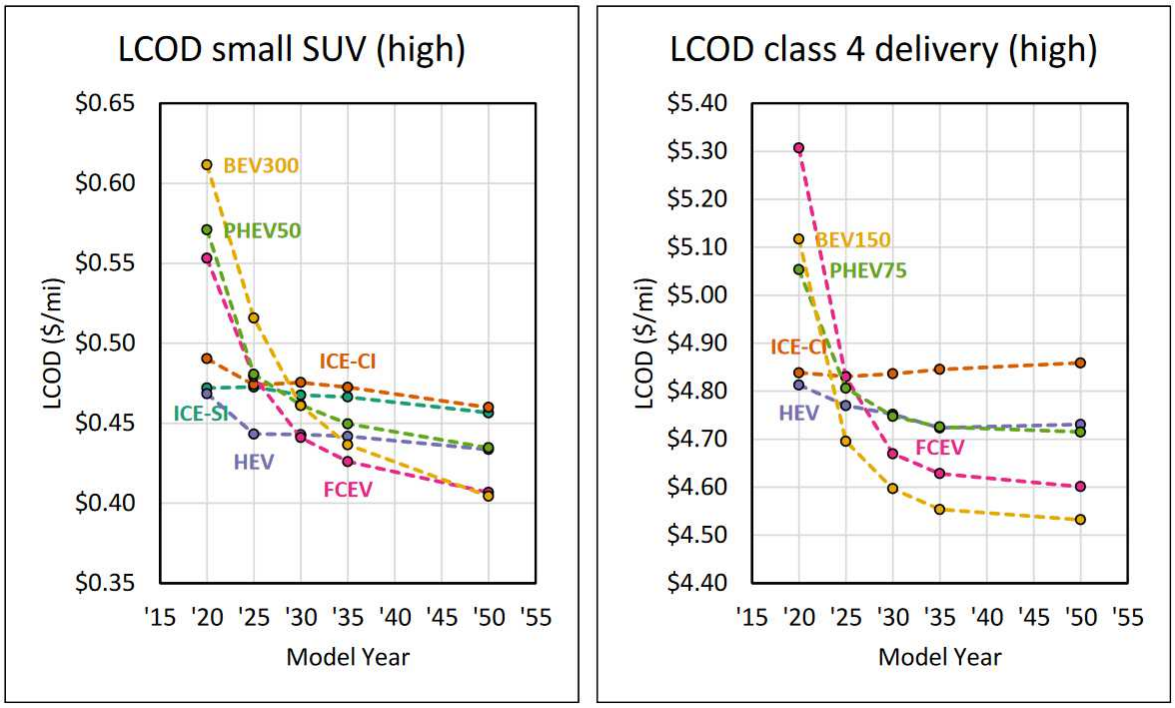
> "Looking ahead, EV manufacturers should connect with EV-interested consumers through persistent brand messaging. We know from our 2022 Super Bowl research that EV-interested consumers have shown consistently higher ad favorability and recall, and not

[24] U.S. Department of Energy, FOTW #1042 (August 13, 2018), *In 2017 Nearly 60 percent of All Vehicle Trips Were Less than Six Miles*, https://www.energy.gov/eere/vehicles/articles/fotw-1042-august-13-2018-2017-nearly-60-all-vehicle-trips-were-less-six-miles.
[25] Drive Clean, *Plug-in Hybrid Electric Cars*, https://driveclean.ca.gov/plug-in-hybrid.
[26] www.fuel econcomy.gov, https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=45751 (visited December 1, 2022).
[27] U.S. Department of Energy, Alternative Fuels Data Center, *Charging Electric Vehicles at Home*, https://afdc.energy.gov/fuels/electricity_charging_home.html.
[28] J.D. Power, *Release on Public Charging quarterly survey results Electric Vehicle Experience (EVX) Public Charging Study*, https://www.jdpower.com/business/automotive/electric-vehicle-experience-evx-public-charging-study.

> just with messaging from automotive companies focused on EVs. At the same time, the EV-hesitant audience is still highly nuanced. Manufacturers should draw them in not only by addressing price and supply issues, but also by offering relevant education and community outreach programs."[29]

Total Cost of Ownership. The Argonne National Laboratory report cited above, compared costs, such as purchase price, taxes and fees, insurance, financing, fueling, maintenance, and repair for projected 2025 model year ICE and ZEV vehicles. Argonne then developed levelized total costs for each vehicle type studied. Figure 2 shows the levelized (all) costs for small SUVs and delivery vehicles through 2055. Incentives are not included in the analysis because they are a mechanism to increase demand rather than recover costs.[30]

Figure 2. Levelized costs of two vehicle types assuming technological and other cost improvements[31]



Note: Figure 4.7 from Argonne National Laboratory Report

There are Economic Development Opportunities for Connecticut in the EV Transition. Connecticut's economy includes technology industries spanning aerospace and marine transportation products, electronic controls and software, and renewable energy production and storage. These current industries and the advanced technology training of the state's workforce

[29] Lisa Whalen, *In the American EV Market, What Drives the Interested and Holds Back the Hesitant?*, Morning Consult (May 4, 2022), https://morningconsult.com/2022/05/04/american-ev-market-interest/.
[30] *Supra*, note 20 at 136.
[31] The designations ICE-CI and ICE-SI refer to conventional internal combustion engine vehicles with compression ignitions or spark ignitions, respectively.

can be leveraged to support and gain economic growth from the transition to electric vehicles. Conversely, Connecticut has a smaller position in industries related to petroleum products and related automotive engine parts, so the state has limited exposure to future shrinkage in these industries. This creates opportunities for the state to grow and attract new economic activity associated with expansion in demand for electric vehicles. However, for opportunities to be fully realized, there needs to be a coordinated and sustained economic development strategy that builds upon these opportunities. A discussion of economic development opportunities is found in the Economic Analysis section of this report.

Background Research

Leading State's Decarbonization/Electric Vehicle Plans

This report section deals with legal, legislative and regulatory history, current incentives in four states for EV rebates and charger support, discussion of the Inflation Reduction Act and aspects of it that may impact the role of federal rebates in the rate of EV adoption in Connecticut.

The Regulatory Context for the Advanced Clean Cars II Program

The Clean Air Act, initially passed in 1970, and notably amended in 1977 and 1990, set national standards for controlling a variety of atmospheric pollutants, such as nitrogen and sulfur oxides (NO_x and SO_x) emissions from all classes of vehicles. The Act generally pre-empts states from setting their own standards. However, California, was a leader in setting pollution control standards for motor vehicles due to the state's severe air quality problems resulting from the volume and density of its traffic. Because of California's leadership in this area, predating federal efforts, California was granted a preemption waiver in Section 209 of the Clean Air Act. The waiver allows California to set its own motor vehicle standards for controlling pollution, reducing sources of smog, acid rain and other pollutants and setting its own testing procedures and standards under a process administered by the Environmental Protection Agency. Section 177 of the Act allows other states to adopt the California standards instead of less stringent federal standards.[32]

The initial California standards for low emissions vehicles (LEVs) of 1990 included a section on Zero-Emission Vehicle (ZEV) standards. Regulatory authority for improving vehicles emissions was assigned to the California Air Resources Board (CARB). Over time, California's regulatory regime has increased its focus on ZEVs resulting in the Advanced Clean Car regulations, a comprehensive set of requirements and procedures for transitioning to zero-emissions "clean

[32] US EPA, *Clean Air Act Requirements and History*, https://www.epa.gov/clean-air-act-overview/clean-air-act-requirements-and-history.

cars," including cars, light-duty and medium trucks, and heavy trucks setting required emission reduction achievements and timelines for each class of vehicle.[33]

At present, at least 16 States have adopted or are adopting ZEV policies based on California's standards: Colorado, Connecticut, Maine, Maryland, Massachusetts, Minnesota, New Jersey, New Mexico, New York, Nevada, Oregon, Rhode Island, Virginia, Vermont, Washington, and California.[34]

Development of Federal Incentives for EVs

The first federal incentives to encourage consumers to purchase low emissions vehicles were issued under the 2005 Energy Policy Act revisions, as described in an IRS bulletin.[35] Credits up to $3,400 were issued for hybrid vehicles, up to a limit of 60,000 vehicles per manufacturer.

Credits for Qualified Plug-in Electric drive vehicles (EVs and PHEVs) were authorized in the American Rescue and Recovery Act (ARRA) in 2009, providing incentives for PHEVs starting at $2,500 for minimum 5 kWh capacity batteries up to $7,500. Credits were wound down as each manufacturer's qualifying vehicle sales exceeded 200,000. The federal Inflation Reduction Act passed in 2022 will remove the 200,000-vehicle cap as of January 1, 2023.

State Incentives for EVs

The National Conference of State Legislators reports that as of April 2022, 45 states offer some form of incentive for EVs, from simply informing the public of federal tax credits to a variety of state incentives. The incentives range from tax credits or rebates to fleet acquisition goals, exemptions from emissions testing or utility time-of-use rate reductions. For example, New York provides state purchase incentives and offers discounts on toll roads, and the use of HOV lanes. Connecticut, California, and Vermont provide incentives for purchasing used ZEVs and assistance for low-income consumers.

The table and section below briefly describe several key characteristics of the EV transition in four leading states, Connecticut, California, New York, and Massachusetts. The incentive schemes can be complex and vary by vehicle type or usage. Each state has adopted the California waiver of EPA's Section 177 regulations and there are substantial similarities among them. States are further advancing the transition to EVs with new features in accordance with their priorities, policies and legislation. Market share percentages are subject to change as reporting organizations get updated sales reports.

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[33] California Air Resources Board, Advanced Clean Cars II Rulemaking (2022), https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-ii.

[34] California Air Resources Board, *States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act* (May 13, 2022), https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177_states_05132022_NADA_sales_r2_ac.pdf.

[35] IRS Fact Sheet, *Highlights of the Energy Policy Act of 2005 for Individuals*, https://www.irs.gov/pub/irs-news/fs-06-14.pdf.

Table 4. Comparison of EV Program Characteristics in Four Leading States

	Connecticut	California	New York	Massachusetts
EV Registrations	BEV: 15,268	BEV: 794,370	BEV: 56,850	BEV: 15,481
	PHEV: 10,126	PHEV: 406,451	PHEV: 46,169	PHEV: 9,278
	FCEV: 8.8[36]	FCEV: 13,695		ZEM: 30
EV Percent of New Car Sales (January to June 2022)[37]	6.83%	18.32%	5.16%	7.43%
State Incentives (Rebates)	BEV: $2,250	BEV: $2,000 - $4,500	Rebates: Varying incentives for EVs by mileage range, from $500-$2,000. Only $500 Incentive MSRP > $42,000	BEV: $2,500/3,500*
	PHEV: $750	PHEV: $1,500 - $2,000		PHEV: $1,500
	FCEV: $7,500	FCEV: $4,500		FCEV: $3,500
	MSRP Cap: $50,000	MSRP Cap: $50,000		MSRP Cap: $50,000/ $55,000*
Additional "Income Qualified" Rebates	BEV: $2,000	BEV: $4,500	None	$1,500*
	PHEV: $1,500	PHEV: $3,500		
	FCEV: $2,000	FCEV: $7,000		
State Funded Used Car Incentives	Up to $3,000 for income qualified residents who purchase or lease eligible used EVs from a licensed dealership.	Up to $9,500 in rebates or $7,500 in transit mobility options.	None	$3,500*

Note: EV program rebate levels as of October 1, 2022. Rebate levels can change as programs evolve.

* Program incentives marked with an asterisk indicate changes effective November 10, 2022.

[36] Auto Innovate 2022 Q2 Report, https://www.autosinnovate.org/posts/papers-reports/Get%20Connected%20Electric%20Vehicle%20Quarterly%20Report%202022%20Q2%209-13-22.pdf.

[37] *Id.*

Charging Incentives

Developing the charging infrastructure to power EVs is as important as providing purchase incentives. The developing charging infrastructure network includes three levels of electric vehicle supply equipment (EVSE), or EV chargers.

Level 1. Expectations are that many homeowners will charge their cars from their homes. Cars can be charged at household voltage, which takes multiple hours, and portable plug-in chargers are commonly provided with vehicle purchase. Installed level chargers cost estimates vary greatly ranging from $300-$800 for the charger plus installation, bringing total installed cost to about $1,000 or more.

Level 2. Higher voltage chargers shorten charging time dramatically, depending on the car and the charger amperage but also have higher purchase and installation costs, generally requiring a certified electrician as well as other labor. Level 2 chargers are installed in a variety of public and private spaces such as workplace garages, allowing employees to charge their vehicles while at work. Level 2 residential chargers and installation costs vary greatly with one source citing the range as $750 - $2,600, depending upon the installation needs.[38] Commercial Level chargers which can accommodate more than one port at a time cost more because of differences in the chargers, physical site requirements, local codes and other factors.

Level 3. Direct Current chargers operate at much higher voltage and can be configured to serve multiple vehicles but cost substantially more than Level 2 chargers. These chargers may find their greatest use as journey or destination chargers located at highway rest stops, outside stores, or at other strategic locations. Level 3 chargers use DC current and can charge at very high voltage very quickly, but typically require 3-phase electricity and a variety of control equipment. The California Energy Commission tracked 225 DC Fast Charger installations of 1-4 chargers, finding for 1 installed DC fast charger, the average rebate per charger was $62,516, the average unit cost per charger was $45,293, and the average total project cost per DC fast charger was $114,674.[39] Project cost for 4-unit chargers was about $10,000 less.

Connecticut has established a nine-year incentive program for EV charging infrastructure through the electric distribution companies.[40] This program covers up to 50% of the cost of the charger, up to $500 for residential electrical upgrades and up to 100% of commercial make-ready costs depending on the type of charger.[41]

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[38] Electric Car Charging Station Installation Cost, Homeguide.com, https://homeguide.com/costs/electric-car-charging-stations-cost#:~:text=A%20240-volt%20Level%202%20charging%20station%20costs%20%24350,include%20app%20monitoring%2C%20thermal%20regulation%2C%20and%20programmable%20scheduling.

[39] CALeVIP DC Fast Chargers, Average Rebate, Unit Cost, and Total Project Cost per Charger, https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/california-electric-vehicle/calevip-dc.

[40] Connecticut Public Utilities Regulatory Authority, Docket No, 17-12-03RE04, PURA Investigation into Distribution System Planning of the Electric Distribution Companies – Zero Emission Vehicles, Decision (July 14, 2021), https://portal.ct.gov/-/media/PURA/electric/PURA-Establishes-Statewide-Electric-Vehicle-Charging-Program.pdf

[41] *Id.* at 17.

Level 2 and 3 battery chargers not only require the cost of the charger and its installation but require maintenance as well. It is not clear what arrangements for operations and maintenance (O&M) are made in any of the four states. However, grants provided through the National Electric Vehicle Infrastructure (NEVI) program require the state recipients to implement a robust O&M plan.[42] Connecticut was among the first round of NEVI grantees.[43] Table 5 below describes charger goals, incentives and other characteristics.

[42] U.S. Department of Energy, Alternative Fuels Data Center: National Electric Vehicle Infrastructure (NEVI) Formula Program, https://afdc.energy.gov/laws/12744#:~:text=The%20U.S.%20Department%20of%20Transportation%27s,collection%2C%20access%2C%20and%20reliability.

[43] U.S Department of Transportation Federal Highway Administration, Approval of Connecticut Electric Vehicle Infrastructure Deployment Plan (September 14, 2022), https://www.fhwa.dot.gov/environment/nevi/ev_deployment_plans/ct_approval_letter.pdf.

Table 5. Charging Goals and Incentives

State	Connecticut	California	New York	Massachusetts
Goals	60,000 charging ports by 2030. 50,000 residential installations; almost 5,000 "destination" chargers; >7,000 in workplaces and serving light-duty fleets; 550 direct current DCFCs.	250,000 chargers by 2025, including 10,000 fast chargers. 1.2 million by 2030 including 50,000 fast chargers. To date, 80,000 chargers installed, mostly level 2.	50,000 level 2 chargers and 1,500 DC fast chargers by 2025. Emphasis on destinations.	At least 800 fast charging stations located along major state highway corridors, usually within five minutes of the roadway exit.
Residential Incentives	$500 rebate on qualified Level 2 residential chargers + $500 for wiring + enrollment in demand management program.	California State Elec. Infrastructure - Regional rebates vary $6,000-8,500 for Level 2. $80,000 for Level 3. Plus, variety of incentives by electric utilities and Air resources Boards, with large variations around the state.	Income tax credit of up to $5,000 for charging stations. Up to $4,000 incentive for multifamily buildings, shopping centers. Con Ed and PSEG offer additional rebates.	Grants for 60 percent of the cost of Level 1 or Level 2 EV chargers installed at multi-unit dwellings, up to $50,000 per address. Additional utility rebates.
Commercial Incentives	Up to 50% of EVSE cost plus up to 100% of make-ready installation. Project specific caps (up to $250,000 per site for DCFC in underserved communities). Also includes multifamily buildings.	Same menu as residential	Public, Workplace - 60 percent of the funding to a maximum of $50,000 per street address for hardware and installation costs. NYSERDA currently out of funds.	Commercial up to $20,000, doubled in under-served communities.

Note: **California Regional Air Resources Boards** and municipal and investor-owned utilities set their own programs with widely varying incentives, similar to EV purchase incentives.

Inflation Reduction Act

On August 16, 2022, President Joseph Biden signed the Inflation Reduction Act (IRA) into law. The Act addresses a range of economic and other issues, focusing on health care and taxes, and provides approximately $369 billion for carbon-reduction measures, including a range of incentives and requirements intended to support the transition from fossil fuel use to renewable energy, and from ICE vehicles to ZEVs, principally electric vehicles.

The IRA broadens incentives for purchases of electric vehicles, primarily through additional tax credits that can be transferred to auto dealers, beginning in 2024, as well as expanding eligibility for tax credits to used vehicles. It removes the 200,000-unit sales cap that disqualified Tesla and

GM vehicles under the previous law. It sets MSRP caps by vehicle type and includes income eligibility caps.

Table 6. IRA Tax Incentives by Vehicle Type

Vehicle Type	Maximum MSRP for New, Sale Price for Used	Incentive	Other
New Car	$55,000	$7,500**	Must meet assembly and domestic content requirement/material requirements
SUV/Pickup Truck	$80,000*		
Used Cars	$25,000	$4,000 or 30% of price, whichever is less	May not need to meet content requirements. Weigh <14,000 lbs.

Notes: * Definition of what vehicles are SUVs may need clarification, primarily "crossover" vehicles. ** The maximum rebate amount available if all requirements are met.

Assembly and Content Requirement. Cars must be assembled in North America. Batteries must be U.S. manufactured and the percentage of the value of applicable critical minerals, primarily lithium, recycled in North America or extracted or processed in a U.S. free-trade agreement country, must be at least 40 percent in 2023, increasing to 80 percent in 2027. Automaker plans indicate that many are moving to develop domestic battery manufacturing, yet the aforementioned material requirement still applies. There are 23 countries with identified lithium reserves. The six major countries are, in order of size of reserves: Chile, Australia, Argentina, China, Bolivia, and the U.S. In 2020, over 80 percent of lithium production flowed from 13 mines: 6 in Australia, 2 in Argentina, 2 in Chile, and 3 in China.[44]

Automakers and others have expressed concern about the timing of incentives, MSRP caps, and assembly/ materials content requirements.

Timing. The only change to the existing EV credit that takes effect after August 16, 2022, and before the end of 2022, is the introduction of the North America final assembly requirement. Otherwise, the rules in effect before enactment of the Inflation Reduction Act for the EV credit remain in effect, including the phase-out for manufacturers that have sold over 200,000 vehicles in the United States.[45]

MSRP. The MSRP cap will make several higher priced autos ineligible for incentives going forward. KBB.com (Kelley Bluebook) reports the average EV cost at $67,000, although there are a significant number of EVs on the market that fall below the $55,000 MSRP cap for light duty vehicles.[46] This may move some manufacturers to scale back some features and accessories to

[44] Journal of International Economic Law, Volume 25, Issue 1 (March 2022) Pages 148-170, https://doi.org/10.1093/jiel/jgac002.
[45] Frequently Asked Questions on the Inflation Reduction Act's Initial Changes to the Electric Vehicle Tax Credit (treasury.gov)
[46] *See, e.g.,* Connecticut CHEAPR, "New Eligible Vehicle List" at https://portal.ct.gov/-/media/DEEP/air/mobile/CHEAPR/CHEAPR-New-Eligible-Vehicle-List-Modified-9-8-2022.pdf (identifying eligible vehicles pursuant to Connecticut's lower $50,000 MSRP cap).

meet the cap. There could also be some vehicle classification issues. A number of current "crossover" vehicles may be put forward as EUVs (Electric SUVs) even though they don't meet the weight range specified for SUVs.

Where was it Made? Because many automakers are truly international, individual vehicles made by some companies may be assembled in North America, but others may be assembled elsewhere and therefore would not be eligible. Consumer Reports recommends that buyers obtain the Vehicle Identification Number (VIN) of a car to be purchased to learn where the car was assembled, information encoded within the VIN.

Income Limitation and Calculation The IRA establishes that individuals whose income is above $150,000 or couples with a $300,000 annual income are not eligible for the incentives. In determining income eligibility the standard will be Modified Adjusted Gross Income which includes several types of income that are typically excluded from Adjusted Gross Income, such as individual retirement account contributions, student loan interest paid and other items exempted from Adjusted Gross Income on tax returns. How this income eligibility issue will be handled in the purchase and rebate process, once tax credits for purchasing EV's go directly to dealers in 2024, is unknown at this time.

Potential Effects on Connecticut EV adoption

Plans of the major automakers should greatly expand the choice and availability of EV models for Connecticut's consumers, especially as provisions of the IRA become effective. However, because of some of the IRA content provisions, full implementation seems likely to be slowed, making Connecticut's state-level incentives much more important in the current and near-future EV transition. Automakers have expressed concerns that the new federal rules coming into effect in 2023 will serve to slow the EV transition, despite automakers' investment efforts to ramp up domestic production of both vehicles and batteries.

To date, the bulk of EVs have been high-end vehicles by Tesla, with more high-end vehicles emerging from most of the major manufacturers. Tesla has not qualified for a federal tax incentive for several years, yet it still leads the BEV market. To continue to promote sales under the IRA, some high-end manufacturers may provide their own incentives to serve their target customers. Lacking access to federal incentives may not be a barrier to the sale or lease of these EVs.

The lower end of the EV market, represented by vehicles such as the GM Bolt, Nissan Leaf, Hyundai Ionic and several Kia models, may do relatively well in states like Connecticut. Generous incentives for lower end EVs for low- and moderate-income buyers, and increased emphasis on used BEVs and PHEVs can take up some of the slack, assuming the battery materials issue can be successfully addressed. It is much too soon to tell how things will play out but moving forward with state incentives in the short term may be the best path.

Development of Alternative Fuels

Economic Factors in Vehicle Fuel Choice by Vehicle Type, Usage for LDVs, MDVs, and HDVs

The earliest powered vehicles in the late 19th century were battery powered. Electric vehicles had advantages over ICE vehicles, including lack of combustion emissions, but did not prevail in the marketplace. There are various explanations for the eventual dominance of ICE vehicles, including the higher purchase cost of electric cars (though lower operating costs), relative limitations on battery range and speed, marketing, and the relative lack of development of charging infrastructure compared with existing gasoline infrastructure.[47]

The need to decarbonize the environment is leading to the reduction and possible eventual elimination of ICE vehicles, but the question from an economic perspective then becomes what are the most appropriate technologies for varying vehicle types and their varying uses? Lithium powered batteries are currently the dominant technology but according to The New Scientist, multiple other battery types are being investigated, including sodium, magnesium, iron-air and liquid (flow)[48] Scaling up production of BEVs can result in lower total costs depending upon the type of vehicles considered, their usage, and other factors such as vehicle miles traveled (VMT). Another commercially available alternative is fuel cells, powered by hydrogen gas. Each of these technologies have strengths and weaknesses from an economic perspective. The question therefore is what are the best uses for them?

To answer this question, studies such as the one recently published by the federal National Renewable Energy Laboratory (NREL)[49] examined the economics from several perspectives. BEVs are currently most economically optimal for light-duty vehicles including passenger cars, pick-up and local delivery trucks. They are also optimal for medium vehicles and heavy-duty vehicles depending upon their usage and when their regular travel is short-to-medium range. Of the various alternatives, the fuel cell approach, using extracted hydrogen in FCEVs is the most developed and is being actively explored as an economic alternative. However, the most environmentally sustainable form of extracted hydrogen, "green hydrogen", has a higher cost compared to other fuels. Hydrogen can be extracted from natural gas (blue hydrogen) and is the cheapest available source to power fuel cells, but there are significant emissions from its extraction and use, limiting the carbon reduction benefit from its use in fuel cells.

According to NREL and other analyses, FCEV heavy-duty vehicles used for long haul transport are expected to be the better economic choice in this case because of their advantages over batteries in refueling time, weight, capacity, and cost. On the road experience will test these assumptions. NREL notes the substantial caveat that the cost of green hydrogen as a fuel will have a large impact on FCEV total ownership and operations costs. It is possible that as the cost of green

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[47] Andrew Heinzman, *New Research Shows Why Electric Cars Failed in the Early 1900s*, Review Geek (October 17, 2021), https://www.reviewgeek.com/100742/new-research-shows-why-electric-cars-failed-in-the-early-1900s/.

[48] *Are there any lithium battery alternatives?*, *New Scientist*, https://www.newscientist.com/question/lithium-battery-alternatives/.

[49] National Renewable Energy Lab, *Decarbonizing Medium and Heavy-Duty On-Road Vehicles: Zero-Emission Cost Analysis* (March 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

hydrogen comes down over time, and availability increases, FCEVs will look like the better choice in some other vehicle types and usages.

SP Global reports, "green hydrogen produced with renewable resources costs between about *$3/kg and $6.55/kg*, (emphasis added) according to the European Commission's July 2020 hydrogen strategy. Fossil-based hydrogen costs about $1.80/kg, and the commission estimated the cost of hydrogen production that pairs carbon capture with steam methane reformation of natural gas, at about $2.40/kg."[50]

There are several reasons why the costs of green hydrogen are expected to fall. A number of new technologies are in development in the U.S. and around the world. Incentives in the IRA for improvements in hydrogen production techniques and the building of hydrogen generation include 10-year subsidies ranging from $0.60/kg generated to $3/kg for the lowest emission processes, and $8 billion for the establishment of regional hydrogen hubs to further hydrogen development. Beyond the subsidies, hydrogen production will benefit from scaling up to commercial/industrial uses, refinements in materials and processes and other economies of scale. The largest portion of this work is expected to focus on industrial processes where hydrogen can substitute for high temperature fossil fuels that produce a substantial quantity of greenhouse gases.

EV Forecast and Economic Analysis

A transition to EVs in Connecticut will have significant implications for the statewide economy. This section explores the impacts of electrification by comparing EV growth under the policy to a business-as-usual (BAU) scenario where EVs still expand in Connecticut, but not as quickly. A variety of economic impacts result from the EV scenario. They fall into the following categories:

- Energy dollars kept in-state – gasoline and diesel fuel expenditures (now flowing to out-of-state producers) are avoided.
- Business growth and development – potential growth of Connecticut-based suppliers and distributors of electric vehicle parts, batteries, maintenance services, charging stations, and energy generation and related new technology development, all of which can offset losses of gasoline and diesel vehicles, fuels, and maintenance activities.
- Long-term cost savings to residents and businesses due to lower fuel/energy and maintenance costs of EVs, leading to more disposable income for residents and greater productivity for businesses, in turn generating more net disposable consumer income within Connecticut.
- Broader job and income growth within Connecticut – occurring as a direct consequence of the preceding three classes of impact, which will lead to further indirect effects on the

[50] Tom DiChristopher, *Experts explain why green hydrogen costs have fallen and will keep falling*, S&P Global Market Intelligence (March 5, 2021), https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/experts-explain-why-green-hydrogen-costs-have-fallen-and-will-keep-falling-63037203#:~:text=Fossil%2Dbased%20hydrogen%20costs%20about,%2C%20at%20about%20%242.40%2Fkg.

growth of Connecticut-based suppliers serving the benefitting industries, and induced effects on workers re-spending their added income on consumer purchases within Connecticut.

Electric Vehicle Forecast

To estimate various benefits of Connecticut's proposed EV policy, it was necessary to first develop a forecast of EV sales and adoption. Table 7 summarizes the forecast for select years between 2022 and 2050, including estimates of the share of annual vehicle sales that are EVs, total annual EV sales, cumulative EVs in operation, as well as the additional EVs in operation and their associated vehicle miles traveled (VMT) relative to the BAU scenario. The last two categories form the basis for benefits calculations since we are interested in the net effect of the policy. The BAU scenario assumes that EVs will still experience growth in Connecticut, but not as rapidly as under the policy scenario.

It was necessary to include 2022-2025 before the policy takes effect because of a needed ramp-up in EV sales in order to meet the 100 percent target in 2035. Under the proposed policy, EVs will comprise 100 percent of all sales by 2035. This is an increase from 8.8 percent today and an estimated 68 percent in 2030. Note: The sales forecast does not account for compliance flexibilities granted to vehicle manufacturers, given their current uncertainty. Table 7 shows how this increase translates into annual EV sales and EVs in operation, as well as additional EVs in operation and additional EV VMT compared with the BAU scenario. These differences are what drive the economic impacts.

Table 7. Connecticut Electric Vehicle Forecast

Year	EV Share of Total Sales (Annual)	EV Sales (Annual)	EVs Operating (Cumulative)	Additional EVs Operating Relative to BAU (Cumulative)	Displaced ICE VMT Relative to BAU (Annual)
2022	8.8%	15,600	38,000	12,600	169,716,700
2030	68%	133,900	710,200	496,200	6,687,076,800
2035	100%	210,600	1,227,000	824,400	11,109,304,400
2050	100%	245,600	2,985,200	2,019,400	27,213,726,900

Sources: Connecticut Department of Motor Vehicles, Connecticut Department of Transportation, EVAdoption, Moody's Analytics, U.S. Department of Energy, U.S. Department of Transportation.

The following explains how we derived each EV forecast variable and its underlying assumptions:

- **EV vehicle sales:** Sales forecast provided by EVAdoption, a leading EV consultancy that provides market research for clients around the U.S. EVAdoption's forecast is based on research from a variety of public and private sources. We validated its reasonableness by comparing the EVAdoption forecast to forecasts of EV sales in other states. EVAdoption's forecast ends in 2030. To extrapolate it to 2035, when the policy requires that 100 percent of sales are EVs, we used a linear trendline.
- **EV vehicles in operation:** Provided by EVAdoption through 2030. We used exponential smoothing to extrapolate the forecast to 2050.
- **Vehicle miles traveled:** Calculated by multiplying vehicles in operation by the average VMT per passenger vehicle in Connecticut according to the U.S. Department of Transportation.

Economic Impact Framework

This section describes how we modeled the economic impacts of an EV-driven technology shift. Our analysis uses the framework of IMPLAN, the nation's leading model system for statewide economic impact studies.[51] IMPLAN builds on the national input-output (I-O) accounting tables regarding how each sector of the economy buys from and sells to others, adapted to reflect Connecticut's specific economy and how its business activity also depends on activities outside of the state.

The I-O tables incorporate a "technology matrix" that shows what kinds of resources, parts, and materials are used to generate the goods and services provided by each industry. This approach, building on past surveys of business, is reasonable for evaluating the broader economic consequences of opening, closing, growing, or shrinking a specific type of activity (e.g., gaining or losing a factory or army base). However, it is not reasonable when the economic impact evaluation is for a policy or program that itself will shift the technology matrix by changing the mix of parts and materials being used. That is the case for the shift in car technology from internal combustion to electric vehicles. Accordingly, our analysis focuses on how the technology change will affect the Connecticut economy.

When shifting car technologies, the key impact factors for Connecticut become: (1) the extent to which jobs will be *lost* in industries associated with the older, legacy technology, (2) the extent to which jobs will be *gained* in industries associated with the new, emerging technology; and (3) the extent to which household and/or business costs will change, leading to further productivity and/or spending impacts.

To evaluate impacts associated with factors #1 and 2, we had to consider, (1) the extent to which there will be change in the mix of various manufactured parts and supporting service elements (sales, fuel, and maintenance); (2) the extent to which each of these elements now exists in

[51] Learn more about IMPLAN at https://implan.com/.

Connecticut or is expected to grow in Connecticut as demand increases over time. Our analysis and findings include the following:

1) Some major elements will be relatively unchanged by the technology shift, like the parts supply chain, assembly process, repair and maintenance processes for car frames, bodies, tires, suspensions, steering, lights and air conditioning systems. Both electric and gasoline cars have these same basic systems and parts, so demand for them will be relatively unchanged by the technology shift.
2) Some elements will decline as electric vehicle technology no longer requires fuel pump systems, oil pump systems, and spark/ignition systems. Our analysis of the Connecticut economy shows that the state currently has relatively little in the way of parts manufacturers for these kinds of systems for cars, so there will not be much impact to Connecticut's economy.
3) Some elements will grow, as electric vehicle technology creates demand for advanced technology products including rechargeable (Lithium Ion) batteries, charging stations and equipment, electric motors, and power controls -- not previously required in ICE vehicles. If we also consider the potential for hydrogen fuel cells as an alternative to the battery electric technology for heavy-duty long-haul trucks, then that is another element not in current vehicle products. Our analysis shows that Connecticut already has a growing position in the development and production for each of these advanced technologies, which we discuss further below.
4) Some elements will be transformed. For instance, the switch from gas stations to electric charging stations changes the nature of construction and operation, and the types of jobs they create. Most gas stations have already moved to rely largely on automated self-pump operations with credit card payment. Our analysis notes that the shift to EV charging will push that trend further. It will also shift occupations and required worker skills for installing and maintaining charging station networks.
5) Other elements will be transformed but with muted impact. EVs have fewer physical parts so their reliability is expected to increase with lower repair costs, but that is just extending an existing long-term trend towards greater vehicle reliability. To the extent that there will be a reduction in car maintenance costs, this savings will generate spending in new ways that will also generate other types of jobs.

Economic Impacts

Effects on the economy will occur as a result of shifts in the flow of purchasing and spending from gasoline to electric vehicles, and broader indirect and induced consequences for jobs, income, and tax revenue. Our analysis was based on comparison of two scenarios — a scenario of "business as usual" and a scenario of "shift to EVs." The latter scenario reflects direct effects of shifts in spending for vehicles, fuel/energy and their operation, which reflect changes that can be expected with an accelerated EV transition. Our analysis utilizes the IMPLAN input-output model for Connecticut, which traces flows of dollars to, from, and between buyer and supplier industries in Connecticut. The economic model itself was updated for evaluation of the EV shift scenario, to

account for recent and anticipated future shifts in fuel sources for motor vehicles and electricity generation sources.

Table 8 shows the economic benefits and disbenefits of the proposed policy. We estimated the direct impact of benefits and disbenefits using ratios from various reports and data sources described below. We then estimated the total impact — including effects on suppliers and household spending — using the IMPLAN economic model. In the case of vehicle parts manufacturing, we customized IMPLAN to better reflect the change in technology associated with EVs. The following sections describe each class of positive and negative economic impacts, along with the methodology and assumptions underlying our analysis. The economic analysis represents a total impact over 29 years (2022-2050) and corresponds directly with the gradual phase-in of EVs discussed earlier.

Vehicle & Vehicle Parts Manufacturing Technology

We assume there will be no change among scenarios in total automobile sales, but there will be differences among the scenarios for various car components. Specifically, the rise of EVs will bring a reduction in demand for internal combustion engines, fuel tanks, fuel and oil pump systems, and spark ignition systems, though relatively little of these components are now made in Connecticut. On the other hand, there will be an increase in demand for electric motors, batteries, charging systems, and electronic controls. There is also a price premium of EVs compared with ICE vehicles of about $1,700 per vehicle, on average. We assume the price premium will primarily benefit battery manufacturers and sellers in Connecticut rather than auto dealers or manufacturers of parts used in both EVs and ICE vehicles. We account for this impact in the model, assuming the price of EVs will eventually fall to reach parity with ICE vehicles sometime between 2025-2030.[52]

We accounted for these changes through custom adjustments to the IMPLAN economic model to reflect the change in vehicle technology from internal combustion to electric. This involved two types of changes: (a) changing the parts and equipment, i.e., commodities, that go into vehicle production, and (b) changing the share of commodities that are provided within Connecticut. Changes were based on the state of the automotive industry in Connecticut as well as on interviews we conducted with industry experts. Both changes have the effect of increasing the impact electrification will have on Connecticut, particularly because the state is well-positioned to support the EV industry as we discuss in the next section.

More specifically, the economic growth potential for Connecticut comes from the fact that the state has a growing base of advanced technology firms related to the production of rechargeable lithium-ion batteries, charging systems, and power control systems – which stand to benefit from the growth of demand for electric vehicles. Connecticut also has a significant and growing base of firms developing and applying hydrogen fuel cell technology. The breadth of these industries in Connecticut is demonstrated in the text box on Page 32. For this reason, the Connecticut

[52] "Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy—2025-2035," Consensus Study Report, National Academy of Sciences, March 2021, http://nap.edu/26092.

economy stands to gain jobs in growing technology industries that will more than offset the loss of jobs associated with reduction in need for ICE vehicles.

Vehicle Operation & Maintenance Savings

Since EVs have significantly fewer parts, Connecticut EV owners are expected to save on maintenance and operations costs between 2022-2050.[53] This includes reduced spending on fuel, parts, and repairs compared with ICE vehicles and diesel vehicles. This does not account for costs of insurance, which we assume are similar for EVs and ICE vehicles. These direct savings translate into additional household spending on other goods and services. Estimated EV savings are $0.04/mile compared with ICE vehicles, which is a conservative estimate since EVs are constantly being improved. When applied to the additional EV VMT between 2022-2050, this represents $14.5 billion less spending on vehicle repair (not including fuel). Diesel vehicles are accounted for with ICE vehicles in the economic analysis.

Transition from Gasoline and Diesel to Electric Power

A transition to EVs will reduce demand for gasoline and diesel fuels in the amount of $41.5 billion from 2022-2050, based on 35.1 mpg equivalent for EVs at $4 per gallon. Since Connecticut imports the petroleum it uses,[54] the impact of this spending decrease will be limited to reduced retail markups and state fuel tax revenue (about $8.1 billion).[55] On the other hand, the transition will significantly increase demand for electricity in Connecticut. We estimate that additional EV VMT between 2022-2050 will require $24.8 billion in new electricity expenditures.[56] However, increased electricity spending by Connecticut households will be offset by the reduced gasoline spending, resulting in net savings of approximately $16.7 billion from 2022-2050.

Transition from Gas Station to Charging Station Development

The proposed policy will reduce demand for gasoline and fueling stations while increasing demand for electricity and charging infrastructure. The EV transition will require the development of approximately 1.1 million residential EV chargers and 379,300 public and workplace EV charging ports by 2050.[57] The development of these residential chargers could cost an estimated $2.2 billion between 2022-2050. The development of non-residential chargers could cost $14.3

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[53] Assumes operating and maintenance costs of $0.167/mile for ICE vehicles and $0.04/mile for passenger BEVs, resulting in a savings of $0.13/mile applied to 438.6 million VMT from 2022-2050. Sources for ICE vehicle and BEV operating, and maintenance costs are TREDIS and the California Air Resources Board (CARB) Standardized Regulatory Impact Assessment (SRIA) for the Advanced Clean Cars II (ACC II) regulations, respectively.

[54] Connecticut State Profile and Energy Estimates, U.S. Energy Information Administration (October 20, 2022), https://www.eia.gov/state/?sid=CT.

[55] The Connecticut fuel tax is 25 cents per gallon, https://www.salestaxhandbook.com/connecticut/gasoline-fuel

[56] Assumes an electricity cost of $0.07/mile. This is based on the assumption that the average BEV requires 0.27 kWh/mile, and electricity is priced at a weighted residential-commercial rate of $0.2531/kWh. Weighting assumes 80 percent of charging happens at home and 20 percent happens at public charging stations. Sources include the ACC II SRIA for fuel efficiency, the U.S. EIA Connecticut State Energy Profile for electricity pricing (August 2022 period), and NREL and USDOE for the residential charging share (https://www.nrel.gov/docs/fy21osti/78540.pdf). The analysis also assumes that electricity rates will not increase in future years, on average.

[57] Calculated using the ratio of charging ports to EVs in operation found in Edison Electric Institute (EEI), Electric Vehicle Sales and the Charging Infrastructure Required Through 2030, June 2022. EEI estimates were developed using USDOE's EVI-Pro Lite tool and a charging infrastructure assessment from the California Energy Commission.

billion, which represents increased spending on construction, installation, and equipment that will benefit Connecticut businesses.[58] These EV charger costs are incurred in lieu of spending that would otherwise be incurred for future gas station investments and fuel purchases.

In addition to the direct effects summarized above, the economic analysis considers broader effects on the Connecticut economy. These include "indirect" or "upstream effects," i.e., changes in sales for Connecticut firms that provide parts, materials, and services for the directly affected industries. They also include "induced" or "downstream effects," i.e., changes in sales for Connecticut firms driven by the increase in workers and worker income resulting from the shift to advanced technology EV parts and their suppliers. Table 9 also shows the magnitude of these additional impacts.

Net Economic Impact

Table 8 summarizes the direct changes in spending patterns in Connecticut associated with the EV policy. It reflects a pattern in which EV adoption brings reductions in demand for gasoline and reduced costs of car repair while simultaneously increasing demand for electricity and charging stations. There are also higher initial vehicle costs associated with EVs, at least until 2025-2030 when they are expected to reach price parity with ICE vehicles.[59] These various effects lead to corresponding changes in household spending and revenues to various sectors of the economy. Most of these gains and losses cancel out in terms of total income. However, there is one very notable change: Connecticut has little to lose in terms of income from producing parts for internal combustion engines and supporting systems, yet the state stands to potentially gain many more dollars in research and development of electronic and electrical systems, controls, and power system elements for EVs.

[58] Assumes that each residential charger costs $2,000 and each non-residential DC fast charger costs $37,584. The source for charger costs is the California Energy Commission.

[59] "Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy—2025-2035," Consensus Study Report, National Academy of Sciences, March 2021, http://nap.edu/26092.

Table 8. Direct Effects of Increased EV Adoption on Patterns of Spending in Connecticut, 2022-2050 (29-Year Total in Billions of Constant 2021 Dollars)

Positive And Negative Impact Categories	Directly Impacted Party	Spending Effect ($B)
Additional Income (or Reduced Cost)		
EV Vehicle Parts Development & Manufacturing in CT	EV Parts Manuf.	+$46.9
Vehicle Operating & Maintenance (Cost Savings)	Households	+$14.5
Electricity Generation (Sales)	Utilities	+$24.8
Public Charging Station Development (Spending)	Installers	+$14.3
Residential Charger Installation (Spending)	Installers	+$2.2
Gasoline Savings	Households	+$41.5
Positive Impacts Subtotal		**+$144.2**
Reduced Income (or Added Cost)		
ICE Vehicle Parts Manufacturing in CT	ICE Parts Manuf.	-$0.2
Additional Electricity Spending	Households	-$24.8
Reduced Gasoline Spending	Gas Stations	-$41.5
Reduced Repair Spending	Repair Shops	-$14.5
Vehicle Purchases (Initial EV Price Premium)	Households	-$6.6
Public Charger Installation	Government & Businesses	-$14.3
Household Charger Cost	Households	-$2.2
Negative Impacts Subtotal		**-$104.1**
Net Income Increase		**+$40.1**

* Accounts for the fact that there is a greater share of Connecticut content in electricity and battery development than there is in gasoline and ICE parts manufacturing.

While Table 8 shows direct effects of changing spending patterns for households and businesses, those direct effects ultimately lead to shifts in employment and value added for various industry sectors in Connecticut. Those impacts are shown in Table 9. Value added reflects the portion of total business income that goes to pay Connecticut workers, buy materials made in Connecticut, and generate profits for Connecticut businesses. This also represents the change in gross domestic product (GDP). Since the Table 9 results reflect just the portion of Table 8 spending changes that affects income within Connecticut, the values in Table 9 are lower than the spending numbers in Table 8.

In particular, Connecticut has negligible manufacturing of ICE components such as gas engines, tanks, transmissions, or coolant systems. Losses from spending on those elements therefore has a minor impact on the state's GDP. On the other hand, Connecticut is home to some electricity generation and development of advanced battery and electric controls, so it stands to gain a larger share of income coming from additional spending on those elements.

More income for Connecticut businesses also leads to "indirect" effects in the form of supply chain orders for parts and materials, some of which are in-state. It further leads to "induced" effects on worker income, which generates further consumer spending effects. All these impacts are shown in Table 9.

When indirect and induced impacts are included, the net impact on employment in Connecticut equals 128,180 additional job-years, representing an average of 4,420 more jobs than would otherwise exist each year. The net impact represents an increase of $25.7 billion in GDP.

Table 9. Economic Impact Results: Changes in Total Job-Years and Value Added (GDP) in Connecticut Due to Increased EV Adoption, 2022-2050 (29-Year Total in Billions of Constant 2021 Dollars)

Positive And Negative Impact Categories	Directly Impacted Party	Total Job-Years	Total Value Added (GDP) Impact
Additions To Business Jobs and GDP			
EV Vehicle Parts Manufacturing (Increased EV Demand)	Vehicle Parts Manufacturers	96,400	+$10.7
Electricity Generation (Sales)	Utilities	75,200	+$9.4
Public Charging Station Development (Spending)	Installers & Parts Suppliers	2,100	+$7.0
Residential Charger Installation (Spending)	Installers & Parts Suppliers	320	+$1.1
Vehicle Sales (Initial EV Price Premium)	Battery Manuf. & Sales	1,940	+$0.2
Positive Impacts Subtotal		**175,960**	**+$28.4**
Subtractions To Business Jobs and GDP			
ICE Vehicle Parts Manufacturing (Reduced ICE Vehicle Demand)	Vehicle Parts Manufacturers	-760	-$0.1
Reduced Gasoline Spending	Gas Stations	-44,700	-$5.9
Reduced Repair Spending	Repair Shops	-55,100	-$7.3
Negative Impacts Subtotal		**-100,560**	**-$13.3**
Net Direct Impact		**75,400**	**+$15.1**
Indirect And Induced Economic Activity (Net Change)	**All Industries**	**52,780**	**+$10.6**
Net Total Impact		**128,180**	**+$25.7**

Model Adjustments

As discussed previously, we made custom adjustments to the IMPLAN economic model to reflect the change in vehicle technology from internal combustion to electric. This involved two types of changes: (a) changing the parts and equipment, i.e., commodities, that go into vehicle production and (b) changing the share of commodities that are provided within Connecticut. Changes were based on the state of the automotive industry in Connecticut as well as interviews we conducted with industry experts. Both changes have the effect of increasing the impact electrification will have on Connecticut, particularly because the state is well-positioned to support the EV industry as we discuss in the next section.

Economic Development Opportunities

This section discusses opportunities for growing and further developing the EV industry in Connecticut. Instead of importing most parts and equipment that go into EV manufacturing, charging station manufacturing, and other forms of infrastructure necessary to support electrification, Connecticut can take steps to produce more in-state. This is known as "import substitution" and is a proven way of maximizing the economic impact of policy changes and new investments.

The transition to EVs also presents an opportunity to develop new occupations and career paths for Connecticut workers. Besides the obvious case of battery and charging facility technologies, the transition to EVs may produce opportunities for skilled designers to develop needed control and financial software, such as interoperability of multiple charging platforms. Additional opportunities in EV charging infrastructure design, installation, and maintenance will also likely become available. Special attention can be given to accelerating demand for supporting industries via municipal and corporate fleet conversions.

It is critical to note that electric cars and trucks still account for a small share of today's vehicles, and their advanced technologies are relatively new. With increasing federal and state incentives and high gas prices, demand for EVs is projected to accelerate substantially in future years. This has spurred continued technology advances to make more efficient, productive, and better performing EVs, and is associated with what is now a flurry of new R&D and investment in new production technologies for battery, charging, motor, and control system elements for EVs.

This means that, for Connecticut, there is an economic development opportunity to attract and grow firms that design and produce these advanced technology elements of EV systems. The impact on Connecticut's economy associated with expanding EVs will not be automatic, for the simple reason that these are rapidly evolving industries, and they are not fixed in where they will locate and grow in future years. However, we can identify reasonable and logical scenarios for likely outcomes based on the current position of Connecticut in attracting investment in these industries, as well as the emerging trends and competitive prospects for the state. The following text box highlights some of these prospects.

Examples of ZEV-Related Advanced Technology Industries

Charging Stations

- Connecticut has already attracted some firms that have become national players in EV charging and expects more future growth as battery technology further evolves.
- EVSE LLC in Enfield makes Autocoil, EVSE and Charge Works brands of charging stations, which are top rated for municipal and fleet systems (e.g., featured on Melrose, Massachusetts' municipal system).
- Juice Bar Charger in Southbury sells commercial charging stations and is in over 100 cities. They are made in Connecticut by Gyre 9.

Lithium-Ion Batteries

- Cadenza Innovation is a Connecticut-based lithium-Ion battery manufacturer that has attracted significant investor base to develop ground-breaking battery pack architectures and global Tier 1 partners.
- BST Systems also makes batteries in Connecticut, currently focusing on deep sea and space uses.
- Ener-Tek International (Yardney division), is another major manufacturer of lithium-ion batteries, currently focusing on defense and industry equipment. It recently moved from Connecticut to an expanded facility in Rhode Island, but it still has supply chain activities spanning Connecticut and Rhode Island.
- Connecticut is a leader in R&D for improving the efficiency of Li-on battery technology and is poised for further attraction of new prototypes for battery manufacturing processes.

Power Controls & Management Systems

- Cougar Electronics provides power inverters for industrial uses as well as railroad and bus use.
- OEM Controls makes battery power management systems for railroads and aircraft.
- Electric Boat makes submarines and Sikorsky makes aircraft, though both have electric supply chains that could be applied for ground vehicles.

Hydrogen Fuel Cells

- This technology produces electricity on-board the vehicle without requiring charging stations. It is expected to be most applicable for long distance trucking and is also being tested for long distance trains.
- Doosan Fuel Cell America, in Connecticut, is one of the largest national manufacturers of fuel cells, and NEL is a leading maker of hydrogen fueling station equipment. Current products are for industry rather than transportation use, but these manufacturers are positioned to make this transition.
- Connecticut is the Hydrogen Hub national leader (though California also has a hub). Connecticut is working with Michigan in putting these technologies together for automotive applications. In fact, CCAT wrote Michigan's hydrogen fuel cell development plan. Connecticut's Hydrogen and Fuel Cell Development Plan was produced in 2018 by the Northeast Electrochemical Energy Storage Cluster.
- CCAT also runs the Connecticut Hydrogen-Fuel Cell Coalition (chfcc.org) whose members include DECD, Connecticut Green Bank, UConn C2E2, Connecticut Clean Cities, Connecticut transit, Connecticut Department of Transportation (CDOT), plus manufacturers such as Fuel Cell Energy (power plants), Infinity Fuel Cell (supports NASA), Precision Combustion (power generation, mfg. uses).
- Connecticut Special Act 22-8 created a task force on hydrogen technology for the state's economic development. Recommendations from the Task Force are due by January 1, 2023.

Our work builds on an analysis of trends in the development of Connecticut's economy and additional economic development insights obtained from conversations conducted with staff of the Connecticut Department of Economic and Community Development (DECD), Connecticut Center for Advanced Technology (CCAT), AdvanceCT, and the governor's Chief Manufacturing Officer. We found strong evidence that Connecticut is one of the recognized national leaders in advanced technology development and implementation, spurred by major industries providing submarines, aircraft, and energy systems for government defense.

The advanced technology workforce skills that have developed, and the high value supply chain ecosystem that has evolved, support advanced technology elements for other watercraft, trains, satellites, and cars. This is part of an intentional strategy being pursued by statewide economic development agencies to further develop Connecticut's economic base, building on the growing EV market. The 2022 Inflation Reduction Act, along with the earlier Infrastructure and Investment Jobs Act, will provide additional resources for a rapid buildup of EV infrastructure, enhanced and broadened EV tax credits, and opportunities for research on hydrogen and other alternative fuels. These will be combined with initial subsidies designed to reduce the cost of renewably generated hydrogen, furthering the work that CCAT is currently engaged in.

Economic Value of Societal Benefits

In addition to the significant economic impacts and benefits of Connecticut's 100 percent EV sales policy detailed above, there are a stream of societal benefits that must be identified and quantified to provide a complete picture of the positive individual and societal impacts of the policy. The two primary societal benefits are health and air quality improvements through the reduction of criteria and toxic pollutants, and the reduction in greenhouse gas emissions.

Health and Air Quality Benefits

Breathing unhealthy air poses serious risks to human health and increases the incidence of many respiratory ailments such as asthma attacks and lung cancer, the leading cause of cancer-related deaths in the U.S. The two primary types of air pollution, ozone (O_3) and particle pollution, including nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter (PM2.5), and volatile organic compounds (VOCs), can increase the risk of other serious impacts on human health, including lung tissue swelling and irritation, developmental damage in children, increased susceptibility to infections, cardiovascular disease, and premature death from heart attacks and stroke.[60] Additionally, air pollution disproportionately affects Connecticut residents in overburdened and underserved communities.[61] Substantial pollution emission reductions in Connecticut will be achieved through the implementation of the ACCII policy, which will result in cleaner, healthier air in the state, particularly in environmental justice communities, improved public health, and reduced health care costs. Our analysis finds that Connecticut's adoption and implementation of the ACC II policy will result in significant pollutant emission reductions between 2022-2050, as detailed in Table 11 on page 36. The avoided emission costs for these air pollutants are detailed in Table 13 on page 41.

Carbon Reduction Benefits

It is well documented by the UN's International Panel on Climate Change (IPCC) that in order to maintain a habitable global climate, carbon emissions must be dramatically reduced in every country and in every emissions sector, in line with the world's remaining carbon budget – the amount of carbon that can still be emitted without exceeding 1.5° C (3.6°F) temperature rise and risking crossing irreversible climate tipping points (i.e., runaway global heating).[62] Table 10 shows that, as of 2020, to have a 67 percent chance of staying under 1.5°C temperature rise, the world's remaining carbon budget is estimated at 400 gigatons of carbon-dioxide equivalent ($GtCO_2e$).

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[60] *The Terrible 10: Air Pollution's Top 10 Health Risks*, American Lung Association (April 6. 2017), https://www.lung.org/blog/air-pollutions-top-10-health-risks

[61] *The Air Quality Health Benefits of Climate Action in Connecticut*, Yale Center on Climate Change and Health (May 2021), https://ysph.yale.edu/yale-center-on-climate-change-and-health/policy-and-public-health-practice/yccch%20air%20quality%20issue%20brief_412616_48542_v1.pdf

[62] *Mitigation Pathways Compatible with 1.5°C*, SR15, Chapter 2, IPCC (2022), https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Chapter_2_LR.pdf

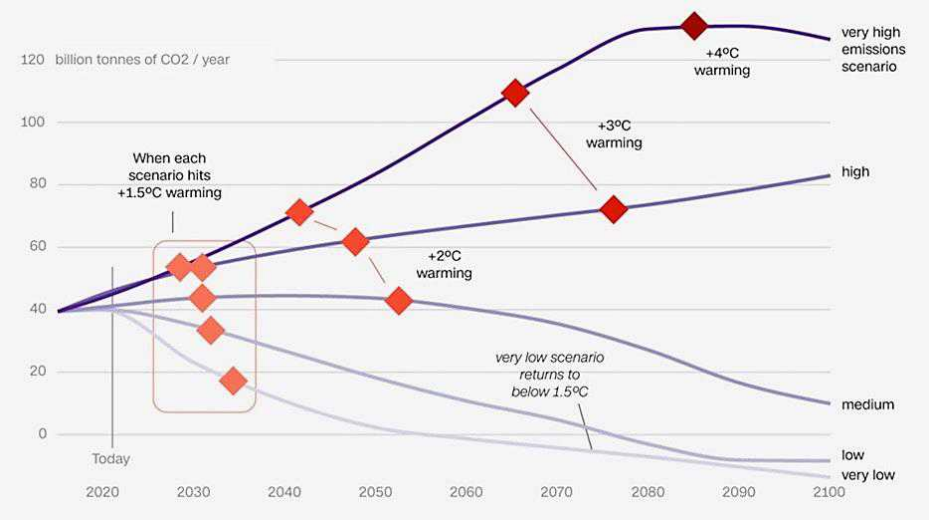
Table 10. Estimated Remaining Global Carbon Budget for Not Exceeding Temperature Rise Thresholds

Approximate global warming relative to 1850–1900 until temperature limit (°C)*(1)	Additional global warming relative to 2010–2019 until temperature limit (°C)	Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$) *Likelihood of limiting global warming to temperature limit*(2)*				
		17%	*33%*	*50%*	*67%*	*83%*
1.5	0.43	900	650	500	400	300
1.7	0.63	1450	1050	850	700	550
2.0	0.93	2300	1700	1350	1150	900

Source: Intergovernmental Panel on Climate Change (2018, October). IPCC special report on global warming of 1.5°C; Ch. 2, p.108.

The most recent report from the IPCC, AR6 Working Group I, concludes that the world is on track to warm by at least 1.5°C in the five scenarios modeled.[63] Figure 2 shows that, even in the lowest emission scenario, the 1.5°C threshold is crossed around 2035. The non-linear nature of abrupt changes in the global climate system, and the prospect of crossing such tipping points, are the principal reason for concern about climate change, and the driving motivation to reduce carbon emissions.[64]

Figure 2. Global Temperature Rise With Five Carbon Emissions Reduction Scenarios



Source: IPCC AR6 Working Group I report; Graphic: John Keefe, CNN/New York Times.

So, the scientific urgency of transitioning Connecticut's light-duty transportation fleet to ZEVs is clear. Connecticut's 2018 Greenhouse Gas Emissions Inventory reveals that the state is not on

[63] 6th Assessment Report, AR6, Technical Summary, IPCC (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf

[64] *The human imperative of stabilizing global climate change at 1.5°C*, *Science* (September 20, 2019), https://www.science.org/doi/abs/10.1126/science.aaw6974

track to meet its 2030 and 2050 Global Warming Solutions Act (GWSA) targets and that transportation-sector emissions remain a key obstacle to achieving the GWSA targets.[65] This underscores that implementation of the policy is essential to meeting the GWSA targets: 45 percent emission reductions below 2001 by 2030, and the 2050 target of 80 percent emission reductions.

Our analysis finds that Connecticut's adoption of the ACC II vehicle standards will result in total estimated emission reductions between 2022-2050 of 137 million metric tons (MT) of carbon dioxide equivalent (CO_2e), 68,700 metric tons of nitrogen oxides (NO_x), 800 metric tons of sulfur dioxide (SO_2), 3,400 metric tons of fine particulate matter (PM2.5), and 81,100 metric tons of Volatile Organic Compounds (VOCs).

Table 11. Estimated Avoided Emissions from Connecticut's Light-Duty Vehicles (2022-2050)

Pollutant Emissions Source	CO_2 ($MtCO_2e$)	Unit
Carbon Dioxide (CO_2)	136,966,000	$MtCO_2e$
Nitrous Oxides (NO_x)	68,700	Metric Tons (MT)
Sulfur Dioxide (SO_2)	800	Metric Tons (MT)
Particulate Matter (PM2.5)	3,400	Metric Tons (MT)
Volatile Organic Compounds (VOCs)	81,100	Metric Tons (MT)

Note: Data based on assumption of a 14.841-year average vehicle life and 13,476 average annual vehicle miles (VMT)[66] Emission calculations based on data from U.S. DOE Office of Energy Efficiency and Renewable Energy[67] and the U.S. Energy Information Administration[68] and assumes a carbon-free electricity grid to charge vehicles by 2040, per Connecticut legislation.[69]

These avoided CO_2 emissions are the pollution equivalent of 3.5 billion tree seedlings grown for 10 years, based on U.S. EPA figures.[70] The avoided emissions of the other four pollutants will have multiple personal and societal benefits as detailed in the next section on societal benefits.

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[65] Connecticut Department of Energy and Environmental Protection, Electric Vehicle Roadmap for Connecticut, 2020.

[66] *How Many Miles Does a Car Last?,* Car and Driver (June 11, 2020), https://www.caranddriver.com/research/a32758625/how-many-miles-does-a-car-last/; *Average Annual Miles per Driver by Age Group*, Federal Transportation Administration, https://www.fhwa.dot.gov/ohim/onh00/bar8.htm; Emission figures from EBP's TREDIS Software Data-Sources-and-Default-Values (March 2022) based on U.S. DOT's *Benefit-Cost Guidance for Discretionary Grant Programs,* https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf#:~:text=This%20document%20is%20intended%20to%20provide%20applicants%20to,benefits%20and%20costs%20of%20a%20potential%20infrastructure%20project.

[67] U.S. Department of Energy, *Beyond Tailpipe Emissions: Results*, https://www.fueleconomy.gov/feg/Find.do?year=2022&vehicleId=43955&zipCode=06838&action=bt3.

[68] U.S. Energy Information Administration, State Electricity Profiles, https://www.eia.gov/electricity/state/archive/2018/connecticut/.

[69] S.B. No. 10, Session year 2022, *An Act Concerning Climate Change Mitigation*, https://www.cga.ct.gov/asp/cgabillstatus/cgabillstatus.asp?selBillType=Public+Act&which_year=2022&bill_num=5.

[70] U.S. Environmental Protection Agency, Greenhouse Gases Equivalencies Calculator, Calculations and References, https://19january2017snapshot.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references_.html.

Societal Benefits

While the emission of carbon dioxide and other harmful pollutants is largely invisible, the personal and societal impacts of these emissions are extensive, consequential and, in some cases, irreversible. The benefits of pollution emission reductions, range from human physical health impacts to food and water security to property and infrastructure impacts to ecosystem and biodiversity impacts. Table 12 categorizes and discusses the primary societal impacts and includes academic study references for each.

Table 12. Societal Impacts of Avoided Carbon and Key Pollutant Emission Reductions

Societal Impact	Description	Reference
Temperature	Heat stress is a leading cause of weather-related human mortality. As temperatures increase due to climate change, heat stress is expected to worsen.	Interactions between urbanization, heat stress, and climate change | SpringerLink
Health and Productivity	Climate change will increase the impact of heat stress on people who work outside or in hot workplaces.	Occupational heat stress assessment and protective strategies in the context of climate change | SpringerLink
Air Quality (PM 2.5)	Air pollution significantly affects human health and climate change is a driver of increased air pollution.	The Interplay of Climate Change and Air Pollution on Health | SpringerLink
Pandemic Disease	Infectious respiratory diseases such as COVID-19 can be affected by climatic and environmental factors, including temperature, humidity, and air pollutants.	Climate change, environmental factors, and COVID-19: Current evidence and urgent actions (cell.com)
Vector-Borne Disease	Vector-borne diseases (e.g., West Nile virus) are sensitive to weather and climate conditions, with increasing temperature and more variable weather increasing their incidence.	Climate change and vector-borne diseases: what are the implications for public health research and policy? | Philosophical Transactions of the Royal Society B: Biological Sciences (royalsocietypublishing.org)
Human Cognition	There is now substantial evidence that permanent exposure to CO_2 levels predicted by the end of the century will have significant effects on humans. Reduced thinking ability and health symptoms have been observed at CO_2 levels above 600 ppm.	Carbon dioxide toxicity and climate change: a major unapprehended risk for human health. (grapevine.com.au)
Social Equity	Climate change will dramatically reduce job opportunities or cause major employment shifts in sectors	The Climate Gap | 17 | Inequalities in How Climate

Societal Impact	Description	Reference
	that predominately employ low-income people.	Change Hurts Americans (taylorfrancis.com)
Intergenerational Equity	Today's carbon emissions will negatively impact today's children as they get older, along with impacting future generations.	Climate Change and Intergenerational Justice | Tracey Skillington | Ta (taylorfrancis.com)
Food Security	The impacts of climate change are a growing threat to agriculture and overall food security.	Climate Change, Agriculture and Food Security: Impacts and the Potential for Adaptation and Mitigation - ScienceDirect
Water Security	Water is vital for human and animal survival and is the primary medium through which the impacts of climate change will be felt.	Measuring water security: A vital step for climate change adaptation - ScienceDirect
Water Quality	Impaired water quality is a global and growing problem, limiting resources for drinking, domestic use, food production, and recreation.	Study role of climate change in extreme threats to water quality | Nature
Drought	Climate change-driven drought is a highly destructive hazard with wide-ranging impacts on food and water security and human health.	A scoping review of drought impacts on health and society in North America | SpringerLink
Wildfires	Higher temperatures and altered precipitation patterns caused by climate change will intensify wildfire risk through the entire U.S.	Forests | Free Full-Text | Assessing Climate Change Impacts on Wildfire Risk in the United States (mdpi.com)
Flooding	Increasing temperatures amplify the atmosphere's water holding capacity and increase the occurrence of extreme precipitation events.	Recent trends in U.S. flood risk - Slater - 2016 - Geophysical Research Letters - Wiley Online Library
Coastal Property	The combined forces of climate change and coastal development have the potential to increase hurricane damage in the U.S. and around the globe.	Projected Increases in Hurricane Damage in the United States: The Role of Climate Change and Coastal Development - ScienceDirect
Infrastructure	Climate change impacts on electricity grid infrastructure is projected to be significant.	Climate change impacts and costs to U.S. electricity transmission and distribution infrastructure - ScienceDirect
Climate Migration	Climate change has the potential to uproot and displace millions of people, and American cities are on the frontline of these future population shifts.	Vulnerable City, recipient city, or climate destination? Towards a typology of domestic climate migration impacts in U.S. cities | SpringerLink

Societal Impact	Description	Reference
Fish And Shellfish	Climate change poses a threat and risk to world fisheries, aquaculture, and seafood security.	Climate change impacts on tropical and temperate fisheries, aquaculture, and seafood security and implications - A review | Request PDF (researchgate.net)
Coastal Wetlands	Coastal wetlands provide significant protection against flood and hurricane damage.	The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA | Scientific Reports (nature.com)
Carbon Storage	Climate change is reducing the capacity of natural sinks to store carbon, for example in oceans, tropical rainforests and boreal forests.	Climate change and carbon sink: a bibliometric analysis | SpringerLink
Biodiversity	Carbon emissions and climate change are a major and growing driver of biodiversity loss globally.	Mapping co-benefits for carbon storage and biodiversity to inform conservation policy and action | Philosophical Transactions of the Royal Society B: Biological Sciences (royalsocietypublishing.org)
National Security	Carbon emission impacts and climate change will pose new challenges for U.S. national security.	The National Security Impacts of Climate Change 10 Journal of National Security Law and Policy 2019-2020 (heinonline.org)
Mental Health	Climate change causes human psychological impacts such as anxiety, stress, depression, and increases in aggression.	Climate Change and Mental Health: AJN The American Journal of Nursing (lww.com)
Crime	A growing body of research suggests a correlation between rising temperatures and increased crime.	Climate Change and Crime Revisited: An Exploration of Monthly Temperature Anomalies and UCR Crime Data - Dennis M. Mares, Kenneth W. Moffett, 2019 (sagepub.com)

With this comprehensive suite of carbon emission and climate change impacts, we have a much more complete picture of the negative personal and societal impacts that can be reduced by implementing carbon emission reduction policies today.

Monetization of Societal Benefits

Multiple studies conclude that climate *inaction* will cost significantly more than climate *action* taken now.[71, 72] The basic economic dynamic is clear, and how much less *action* will cost is a matter of degree determined by which risk factors are being considered and quantified. Monetization of the costs of action or inaction can be accomplished in two ways, by monetizing individual avoided impacts and summing them, or by employing a social cost of carbon (SCC) figure developed using an integrated assessment model (IAM) or other modeling tool. The former is a reductionist approach while the latter represents a more holistic way of monetizing climate action benefits. The SCC is the marginal cost of the impacts of emitting one metric ton of carbon dioxide equivalent into the biosphere and includes impacts on human health, ecosystems, and other factors that do not have a market price. For this report we are using a SCC approach.

The valuation of the SCC varies dramatically according to which 'social impacts' are included, and the calculation method applied to determine the costs of these impacts. The range of SCC in the academic studies and reports reviewed varied from $53/ton, the current U.S. Federal rate, to over $800/ton, the high range of several studies.[73,74] The IPCC suggests that a carbon price from $135 to $5,500/t$CO_2$ in 2030, and from $245 to $13,000 in 2050 (2010 U.S. dollars), would be needed to drive carbon emissions to stay below the 1.5°C limit.[75] In this report we are using the SCC figure developed by the neighboring state of New York, $125 per metric ton,[76] and adjusting it up by 25 percent to $156 per metric ton to account for the avoided impacts of not crossing irreversible climate tipping points that lead to self-reinforcing climate feedback loops and/or cascade to accelerate other tipping point risks (e.g., Amazon rainforest tipping into a net carbon emitter; carbon feedback loops leading to a *hot house earth* state).[77]

The next consideration is the discount rate, which takes into account the reduced value of money in the future, and which also discounts the value of investments made today for the benefit of today's children and future generations. Suggested discount rates range from 0 percent to over 7 percent. Again, we are using the New York State Department of Environmental Conservation's recommended discount rate of 2 percent in our SCC calculations. For the impact of the other four pollutants considered, NO_x, SO_2, PM2.5, and VOCs, we use the U.S. Department of

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[71] The New Climate Economy, The 2018 Report of the Global Commission on the Economy and Climate, https://newclimateeconomy.report/2018/.

[72] *The Turning Point: A New Economic Climate in the United States,* Deloitte (January 2022), https://www2.deloitte.com/content/dam/Deloitte/us/Documents/about-deloitte/us-the-turning-point-a-new-economic-climate-in-the-united-states-january-2022.pdf.

[73] Jarmo S. Kikstra et al, The social cost of carbon dioxide under climate-economy feedbacks and temperature variability, Environmental Research Letters (2021), https://iopscience.iop.org/article/10.1088/1748-9326/ac1d0b.

[74] Ricke, K., Drouet, L., Caldeira, K. et al., *Country-level social cost of carbon,* Nature Climate Change 8, 895–900 (2018), https://doi.org/10.1038/s41558-018-0282-y.

[75] Global Warming of 1.5 ºC, SR15, Chapter 4, Strengthening and Implementing the Global Response, p.374, IPCC (2018), https://www.ipcc.ch/sr15/chapter/chapter-4/.

[76] NYSDEC Value of Carbon Guidance 2022 Update, p.34, https://www.dec.ny.gov/docs/administration_pdf/vocguid22.pdf.

[77] Simon Dietz et al, *Economic impacts of tipping points in the climate system*, PNAS (August 16, 2021), https://www.pnas.org/doi/10.1073/pnas.2103081118.

Transportation's recommended 7 percent discount rate since the primary effects of these pollutants is more immediate.

The total value of societal benefits attributable to the EV requirements included in the ACC II policy between 2022-2050 is approximately $31.5 billion, while the value by 2035 is $4.9 billion. Table 13 provides a detailed breakdown of these values.

Table 13. Estimated Avoided Emission Costs from Connecticut's Light-Duty Vehicles (2022-2050)

Pollutant Emissions Source	Avoided Emission Costs (Billions)
Carbon Dioxide (CO_2)	$27.06
Nitrous Oxides (NO_x)	$1.24
Sulfur Dioxide (SO_2)	$0.039
Particulate Matter (PM2.5)	$2.96
Volatile Organic Compounds (VOCs)	$0.19
Total Avoided Costs	**$31.49**

Medium and Heavy-Duty Trucks

It is anticipated that by 2035, heavy-duty vehicles will emit 61 percent more NO_x emissions than light-duty vehicles (LDVs) due to reduced LDV emissions from stronger new vehicle emission standards.[78] Therefore it will be essential to transition the Connecticut medium and heavy-duty (MHD) vehicle fleet to ZEVs to ensure the state can meet its emission reduction targets.

In 2020, Connecticut joined 14 other states and the District of Columbia in signing a memorandum of understanding (MOU) which provides a framework to coordinate state efforts to meet MHD electrification goals. The MOU stipulates working toward 100 percent ZEV MHD vehicles by 2050, and 30 percent by 2030.[79] The vehicles addressed in the MOU include large pickup trucks and vans, delivery trucks, box trucks, transit and school buses, and long-haul delivery trucks. In 2021, Governor Lamont issued Executive Order 21-3, which directed state agencies to take actions to reduce carbon emissions and address the climate crisis. The Executive Order directed DEEP to "Assess the need to adopt California Medium and Heavy-Duty (MHD) vehicle emissions standards. DEEP shall assess the need to adopt the California Air Resources Board (CARB) standards for MHD vehicles as part of the state's efforts to meet air quality and climate change goals." [80] In 2022, DEEP released a white paper which found that adoption of California MHD standards would substantially reduce criteria pollutant and GHG

[78] Connecticut Department of Energy and Environmental Protection, *Electric Vehicle Roadmap for Connecticut*, (2020).
[79] Multi-State Medium- and Heavy-Duty ZEV MOU (July 2020), https://portal.ct.gov/-/media/DEEP/air/mobile/EVConnecticut/2020-07-14---Mulit-State-MHD-ZEV-MOU.pdf.
[80] Connecticut Executive Order No. 21-3 (December 16, 2021), https://portal.ct.gov/-/media/ConnecticutClimateAction/NML_EO_21-3-_Website_Text_Actions.pdf.

emissions, create economic benefits, and lead to lower health care costs in Connecticut.[81] The Connecticut legislature subsequently passed Public Act 22-25, which authorized DEEP to adopt regulations implementing the California MHDV standards and establish a voucher program to support the purchase of zero-emission MHDVs and provides a timeline for the electrification of the state's bus and school bus fleets.[82]

In July 2022, the Northeast States for Coordinated Air Management's (NESCAUM) ZEV Task Force release their Multi-State Medium and Heavy-Duty ZEV Action Plan, which provides a policy framework to eliminate harmful truck and bus emissions and provide for a just and equitable transition to ZEVs.[83] As noted above, one of the strategies that Connecticut is pursuing is the adoption of California's Advanced Clean Trucks Rule (ACT) which is a manufacturers' ZEV sales requirement and a one-time reporting requirement for large entities and fleets.[84] With the ACT regulation, manufacturers of Class 2b-8 are required to sell an increasing percentage of ZEVs from model years 2026 to 2035. The ACT targets start in 2026 at 10 to 13 percent, depending on truck class, and ramp up to 40 to 75 percent by 2035.

GHG emission reductions with the ACT regulation over the 2026 to 2035 period are estimated at 15.3 $MMTCO_2$, representing a 32.3 percent reduction over the business-as-usual baseline (see Figure 3).[85]

[81] Connecticut Department of Energy and Environmental Protection, *An Assessment of Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emission Standards* (March 8, 2022). https://portal.ct.gov/-/media/DEEP/air/mobile/MHD/MHD_Whitepaper_030822.pdf.

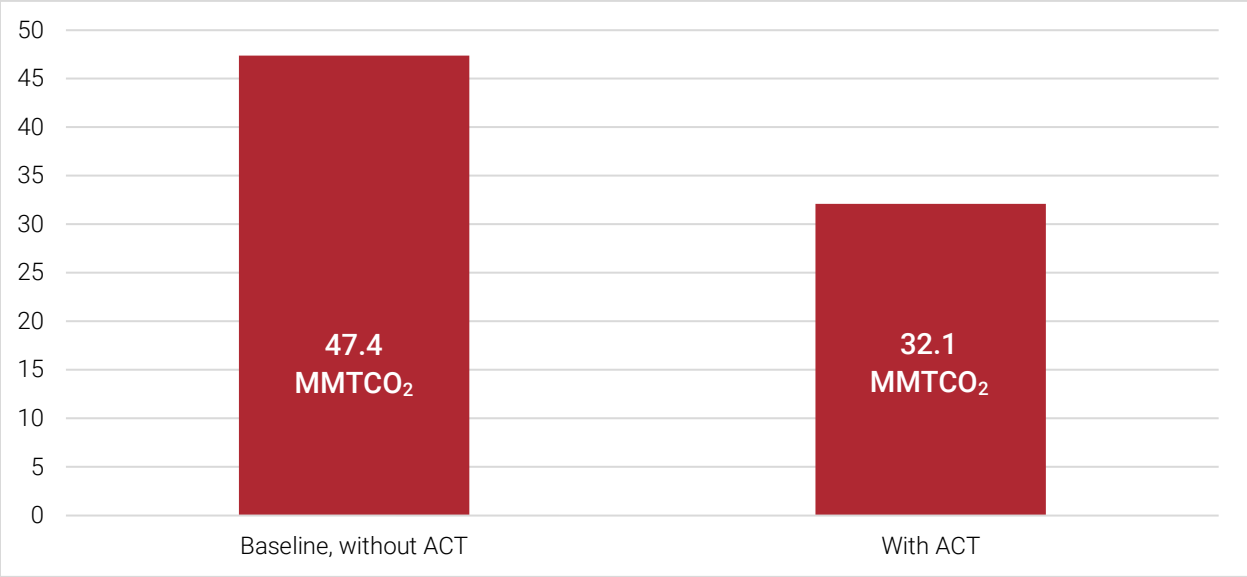
[82] Public Act 22-25, An Act Concerning The Connecticut Clean Air Act (May 10, 2022), https://www.cga.ct.gov/2022/act/pa/pdf/2022PA-00025-R00SB-00004-PA.pdf.

[83] *Multi-State Medium- and Heavy-Duty ZEV Action Plan*, NESCAUM (July 2022), https://www.nescaum.org/documents/multi-state-medium-and-heavy-duty-zev-action-plan-dual-page.pdf.

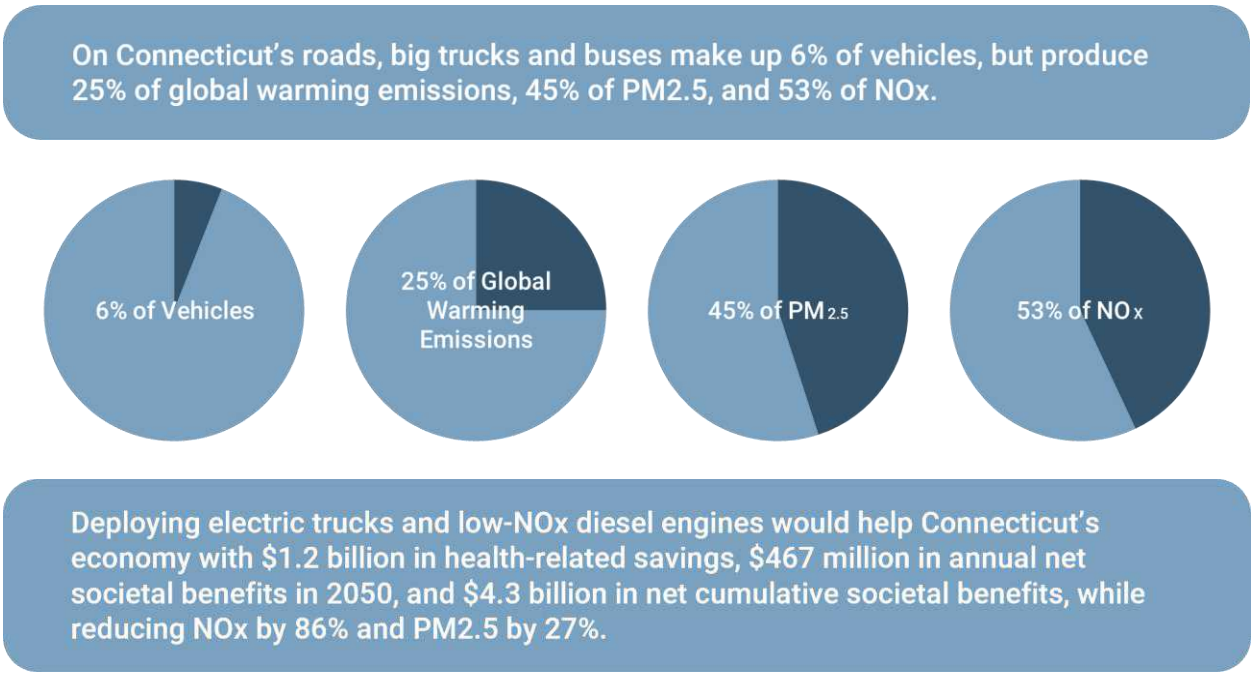
[84] Advanced Clean Trucks, California Air Resources Board, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks.

[85] Data from 2018 Connecticut GHG Inventory and NESCAUM's 2022 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Action Plan.

Figure 3. Baseline CO_2 Emissions from Connecticut Trucks Compared with CO_2 Emissions with the Advanced Clean Trucks Rule (ACT) (2026-2035)



Reducing diesel emissions in Connecticut is vital to improving air quality and public health in underserved and overburdened communities, and to supporting local and regional economic development and job growth. In January 2022, the Union of Concerned Scientists published a short paper on the benefits to Connecticut of adopting ACT.[86] Two of the key takeaways include:



[86] Connecticut Clean Trucks Fact Sheet, Union of Concerned Scientists, (January 2022), https://www.ucsusa.org/sites/default/files/2022-01/ct-clean-trucks-fact-sheet.pdf.

As with the Advanced Clean Cars II policy, adoption of California's Advanced Clean Trucks regulation in Connecticut will benefit the state's public health, environment, and economy.

Hydrogen and Large Trucks

While the consensus of opinion is that hydrogen is not the best alternative fuel for light-duty vehicles, and in most cases medium-duty as well, hydrogen may make the most sense from a decarbonization and economic perspective for large, long-haul trucking, although the economic case is not fully established.[87] Compared to equivalent battery-powered trucks, the lesser weight and bulk of on-board hydrogen storage, allows for larger loads. The higher energy density of hydrogen may allow for longer intervals between stops. Additionally, as with other electric vehicles the simpler engine structure should result in more reliable, less expensive maintenance over the life of the truck. For owners of commercial trucking the combined costs of ownership and operation is the key metric.

In March 2022, the National Renewable Energy Laboratory (NREL) published *Decarbonizing Medium and Heavy-Duty On-Road Vehicles: Zero-Emission Cost Analysis,* a study looking at the economics of medium and heavy-duty trucking, including ICE (Diesel), battery electric and fuel cell vehicles at a range of sizes and uses.[88] The metrics examined using the TEMPO model included upfront vehicle cost, fuel costs (vehicle fuel economy and price), maintenance costs, vehicle usage – miles traveled, discount rate, monetized charging time cost for BEVs, and logit formulation to capture heterogeneous factors. Noting that fuel costs and infrastructure are large variables, the study's major conclusions are:

Improvements in zero-emission vehicle technologies (BEV and FCEV) and fuels in line with U.S. DOE targets, and vetted with industry, enable ZEVs to achieve cost parity with diesel by 2035. Two ZEV tech solutions and pathways for many applications provide more options and mitigate risks:

- BEVs tend to become cost-competitive for almost all light-medium and medium trucks before 2030 and for short-haul (<500-mile) heavy trucks before 2035.
- Hydrogen FCEVs tend to become cost-competitive for long-haul (>500-mile) heavy trucks by 2035.
- Buses can fully transition to ZEV (100 percent sales) by 2030.[89]

These assumptions need proving in the real world and there are pilot programs in various stages of development and operation. The Alberta, Canada, Motor Transport Association will have Canada's first on the road test for long haul trucks by the end of 2022.[90] Several manufacturers

[87] The Hydrogen Economy: For Light Vehicles, Hydrogen Is Not For this Decade, S&P Global Ratings (2022), https://www.spglobal.com/ratings/en/research/articles/210422-the-hydrogen-economy-for-light-vehicles-hydrogen-is-not-for-this-decade-11911374.

[88] National Renewable Energy Lab, Decarbonizing Medium and Heavy-Duty On-Road Vehicles: Zero-Emission Cost Analysis (March 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

[89] *Id.*

[90] Hydrogen Commercial Vehicle Demonstration Program, Alberta Motor Transport Association, https://amta.ca/what-we-do/hydrogendemos/.

including Volvo, Toyota, Daimler and Hyundai are in various stages of developing on the road testing.

As noted previously in 'EV Forecast and Economic Analysis,' Connecticut is a national leader in fuel cell technologies and is well positioned for expanded economic development opportunities related to the use of hydrogen fuel cells in long-haul trucking.

Conclusions

This study and report have detailed the multiple economic impacts and societal benefits associated with Connecticut adopting California's Advanced Clean Cars II ZEV requirements. The conclusion is that the economic impacts and societal benefits are compelling and significant, and that the absence of the policy would jeopardize achieving Connecticut's clean air and carbon emission reduction goals and efforts to improve public health.

Connecticut has a major opportunity to benefit economically from a transition to EVs. The proposed policy will spur EV adoption, which will generate positive economic impacts for households, manufacturers, and service companies throughout the state. Connecticut can also grow its economy beyond the direct effects of EVs by capitalizing on new economic development opportunities around EV-related technologies like energy storage, electrical components manufacturing, and charging station design and manufacturing.

Estimated net economic impacts, benefits and avoided emission costs attributable to adopting ACC II are in Table 14. Economic impacts represent changes in the flow of money in the Connecticut economy, whereas societal benefits have economic value in terms of avoided costs.

Table 14. Estimated Net Economic Impacts, Benefits and Avoided Emission Costs from Connecticut's Light-Duty Vehicles, 2022-2050 (29-Year Total in Billions of Constant 2021 Dollars)

Economic Impacts and Societal Benefits from Connecticut 100% EV Sales Policy	Value of Benefits and Impacts (Billions)
Added Net Business Income (Economic Impact)	$40.1
Value Added (GDP) Growth in Connecticut (Economic Impact)	$25.7
Value of Criteria Pollutant Emission Reductions (Societal Benefits - Local)	$4.4
Value of Carbon Emission Reductions (Societal Benefits – Global)	$27.1

Table 15 highlights key messages and talking points that call out the economic impacts and societal benefits of the 100 percent EV sales policy between 2022 and 2050.

Table 15. Key Conclusions, 29-Year Effect from 2022-2050 (Billions of Constant 2021 Dollars)

Key Conclusions
$40 billion in net business income (economic impact).
$26 billion in net value added or GDP (economic impact).
128,200 net new job-years, representing about 4,400 more jobs than would otherwise exist each year.
$4 billion in value of criterial pollutant emission reductions (societal benefits - local).
$27 billion in value of carbon emission reductions (societal benefits - global).
$42 billion in gross vehicle fuel cost savings.
$15 billion in gross vehicle operating and maintenance cost savings.
Carbon emission reductions of 137 million metric tons CO_2.
Carbon emission reduction equivalent of planting 3.5 billion trees.
Improved air quality from pollution emission reductions of NO_x (68,681 metric tons), SO_2 (796 metric tons), PM2.5 (3,418 metric tons), and VOCs (81,080 metric tons)
The policy will unlock new opportunities for economic development around EV-related technologies.
The policy will ensure Connecticut stays economically competitive by capturing market share in EV-related industries sooner than other states.
Failure to adopt the ACC II policy would jeopardize achieving Connecticut's public health, clean air, and emission reduction goals.
Due to the EV content provisions of the Inflation Reduction Act, full implementation is likely to be slowed, making Connecticut's state-level incentives even more important in the current and near-future EV transition.

From:	**Chapin Bryce** <mail@chapinb.com>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	PR2023-020 / PR2023-023 / Public Act 22-25 Public Comment
Date:	30.08.2023 20:59:22 (+02:00)

To whom it may concern.

My name is Chapin Bryce, a resident and Planning and Zoning commissioner of Norwalk. I support the reduction in emissions within Connecticut. We need to reduce the emissions within this state, and Public Act 22-25 is one part of a solution.

In addition to promoting the use of vehicles with zero or near zero emissions, I would like to further stress our state's need of alternative modes of efficient and environmentally sustainable transportation to reduce our dependency on cars for meeting daily needs. This includes public transportation, micro-mobility devices (such as bikes, scooters, and boards), and the infrastructure required to ensure all types of safe mobility. CT DEEP has demonstrated the demand and interest of residents for smaller alternatives to cars to meet needs across our state through the e-bike incentive program.

State and municipal vehicles should lead the way in ZEV and NZEV adoption, setting an example for how this proposed legislation is feasible for residents. The state should broadcast it's adoption and showcase to businesses and residents how this model works. The CHEAPR statistics page is a great resource for showing the rebate usage for BEV and PHEV interest and could be publicized more to highlight the popularity of such programs and adoption.

Thank you,

Chapin Bryce

From: **Robin Strom** <robinstrom@att.net>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>; **donna.veach@housegop.ct.gov** <donna.veach@housegop.ct.gov>
Subject: PR2023-023
Date: 31.08.2023 00:36:59 (+02:00)

This letter is in response to the announcement by Gov. Ned Lamont that Connecticut will join fifteen other states that conform to California's emission standards rather than federal emission standards set by the Environment Protection Agency (EPA). Last year, California unveiled plans to discontinue the sale of new gasoline-powered vehicles by 2035, after which all new vehicle sales will be zero-emission vehicles, with a focus on electric vehicles (EV). According to a Connecticut law passed in 2004, DEEP's commissioner shall adopt and amend emission regulations implemented by the Golden State.

Reasons not to mandate EV's:

There is no guarantee that we will have an infrastructure completed in Connecticut to support charging electric vehicles, especially for residents of apartments and condos.

Unless all electricity is generated using a renewable source, not fossil fuel, there is still pollution involved in running an electric vehicle.

Batteries for electric cars only go 280 miles on the average before they need recharging.

Batteries for electric cars are manufactured (or necessary minerals are extracted and processed) in foreign countries, such as China and Africa, which do not have the same environmental regs as the US, and they are using fossil fuels in the manufacturing process

There is no long term cost savings to the average citizen for purchasing an electric vehicle and eliminating the need to fill their car with gasoline.

The ban will strip Connecticut consumers of their freedom to choose, place excessive strain on the electrical grid beyond its capacity, lead to extended waiting periods at recharge points and ultimately contribute to an increase in pollution in regions such as Africa and China, where the minerals for batteries are extracted and processed.

Robin S trom
156 Stonebridge Way
Berlin, CT 06037

From: **susanachilles@aol.com** <susanachilles@aol.com>
To: **DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject: PR2023-023
Date: 30.08.2023 13:31:37 (+02:00)

To whom it may concern:

I vote NO to force the population of the State of Connecticut to only purchase electric vehicles.

My reasons:

1) Our electric grid cannot support the added usage - billions of dollars will be required to upgrade the services, and the majority of electricity is created by the buring of fossil fuels, does that make sense?

2) Lithium batteries loose their charge in cold weather, weather that is very common in CT. There is also an uptick in fires caused by lithium batteries. There's a tremendous volume of fire as soon as it happens, and it's very difficult to extinguish and requires up to 8,000 gallons of water to extinguish a lithium car battery fire, a standard gasoline car would be extinguished with 500 - 1,000 gallons.

3) This is a decision that needs to be made by the individual, not the state. The state should encourage, but also needs to ensure adoption by ensuring the cost of electric cars is no more than a gasoline car, that the grid can fully support the added usage, and that the cost of electric by the electric companies is considerably reduced.

Thank you,
Susan Achilles

From:	**Charles Rothenberger** <crothenberger@savethesound.org>
To:	**DEEP MobileSources** <DEEP.MobileSources@ct.gov>
Subject:	PR2023-023 Advanced Clean Cars II
Date:	30.08.2023 21:01:05 (+02:00)
Attachments:	Save the Sound Written Comments on Clean Vehcile Regulations 8.30.23.pdf (8 pages), Save-the-Sound_CT-EV-Policy-Impact-Study_Final_2023-date.pdf (50 pages)

Good afternoon,

Pleased accept the attached comments for Save the Sound in Support of DEEP's proposed ACC II, LEV IV, ACT, and the Low NOx Omnibus regulations.

Don't hesitate to contact me if you have any questions.

Thank you,

Charles J. Rothenberger
Climate & Energy Attorney
Save the Sound
900 Chapel Street, Suite 2202 I New Haven, CT 06510
office: (203) 787-0646, x122
crothenberger@savethesound.org

Save the Sound®
Action for our region's environment.

Save the Sound®
Action for our region's environment.

August 30, 2023

VIA ELECTRONIC FILING

Commissioner Katie Dykes
Connecticut Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106

Email: deep.mobilesources@ct.gov

RE: Proposed Emission Standards for 2027 model year and later Light Duty Vehicles (PR 2023-023)
Proposed Emission Standards for 2027 model year and later Medium and Heavy-Duty Vehicles (PR 2023-020)

Save the Sound is pleased to offer these comments in strong support of Connecticut's adoption of the full suite of regulations being considered (ACC II, LEV IV, ACT, and the Low NOx Omnibus Standards). The regulations build on Connecticut's long-standing commitment to reducing the harmful effects of motor vehicle pollution on our residents and addressing climate change. The standards apply more stringent emissions requirement's to gasoline and diesel cars and trucks, lowering the emission of harmful nitrogen oxides and particulate matter, while also continuing the current program's requirement on manufacturers to provide increasing numbers of "zero-emission vehicles" (which included EVs, plug-in hybrids, and fuel cell vehicles) to market.

Connecticut needs to adopt these more stringent vehicle emission standards to meet compelling air quality issues in the state. These regulations are essential and are fully within the authority of the Department of Energy and Environmental Protection (DEEP) to adopt and implement. Adoption of these standards will ensure more rapid reductions in polluting emissions from conventional vehicles, as well as ensuring that zero-emissions vehicles will be available for sale and use in our state and that our citizens will share in the benefits of reduced emissions and cleaner air.

We urge DEEP to act with all deliberate speed to ensure that Connecticut residents enjoy the full benefits of these incredibly important standards.

Connecticut's Adoption of California Motor Vehicle Emissions Standards is Authorized by and Consistent with Federal Law

California's Authority to Adopt Independent Emissions Standards

California's authority to adopt its own independent motor vehicle emissions standards is set forth in section 209 of the federal Clean Air Act (CAA). The federal Clean Air act provides for the waiver of the general federal preemption of state adoption or enforcement of motor vehicle emissions for any state that adopted motor vehicle emissions standards

prior to March 30, 1966.[1] This exemption, applicable only to California, was adopted in recognition of the state's early leadership in addressing serious air quality issues through its regulation of motor vehicle emissions, among other actions.[2]

Consistent with the CAA's recognition of California's expertise in this area, EPA has limited authority to deny California's request for a waiver.[3] The Environmental Protection Agency must grant the preemption waiver to California if the state has determined that "the State standards will be, in the aggregate, at least as protective of public health and welfare as applicable Federal standards." EPA may only deny the waiver if it finds that (1) California's determination was arbitrary and capricious, (2) the state doesn't need the state standard to meet compelling and extraordinary conditions, or (3) the state standards and enforcement procedures are inconsistent with the Clean Air Act's provisions regarding technological feasibility.[4] Given the strict limitations on denying a waiver, it is not surprising that EPA has never denied a waiver request.[5]

Connecticut's Authority to Adopt California's Emissions Standards

Connecticut's adoption of the California motor vehicle standards is expressly authorized by section 177 of the Clean Air Act, which provides that

> any State which has [national ambient air quality standard nonattainment] plan provisions approved under this part may adopt and enforce for any model year standards relating to control of emissions from new motor vehicles or new motor vehicle engines and take such other actions as are referred to in section 7543(a) of this title respecting such vehicles if—
> (1) such standards are identical to the California standards for which a waiver has been granted for such model year, and
> (2) California and such State adopt such standards at least two years before commencement of such model year (as determined by regulations of the Administrator).[6]

Similar to California, Connecticut needs to adopt more stringent vehicle emission standards to meet compelling and extraordinary conditions. Connecticut has consistently been designated as nonattainment of the national ambient air quality standards (NAAQS) for ozone.[7] Consistent with the framework set forth in the CAA, Connecticut has submitted and received approval from EPA for numerous iterations of its State Implementation Plan (SIP) to address the state's nonattainment status.[8]

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[1] 42 U.S.C. §7543.
[2] *See* California Air Resources Board, *History*, https://ww2.arb.ca.gov/about/history#:~:text=In%201966%20California%20established%20the,Air%20Resources%20Board%20was%20established.
[3] "In waiver decisions, EPA has thus recognized that congressional intent in creating a limited review of California waiver requests . . . was to ensure that the federal government did not second-guess the wisdom of state policy." 87 Fed. Reg. 14332, at 14342 (Mar. 14, 2022).
[4] 42 U.S.C. §7543 (b) (1).
[5]. The Trump administration mounted an unprecedented and Quixotic effort to withdraw a previously granted waiver, but this effort was terminated by the Biden administration. EPA-HQ-OAR-2021-0257, *California State Motor Vehicle Pollution Control Standards; Advanced Clean Car Program; Reconsideration of a Previous Withdrawal of a Waiver of Preemption; Notice of Decision*, 87 Fed. Reg. 14332 – 14379 (Mar. 14, 2022).
[6] 42 U.S.C. §7507.
[7] U.S. EPA, *Connecticut Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants* (current as of July 31, 2023), https://www3.epa.gov/airquality/greenbook/anayo_ct.html.
[8] U.S. EPA, *EPA Approved Regulations in the Connecticut SIP*, https://www.epa.gov/sips-ct/epa-approved-regulations-connecticut-sip.

As part of its nonattainment efforts, Connecticut has a long history of following the California emission standards. This includes adoption of California's Low Emission Vehicle (LEV) regulations beginning in 1994,[9] LEV II (2004),[10] and LEV III (2013),[11] including the relevant Zero Emissions Vehicle (ZEV) and greenhouse gas (GHG) components of such regulations.

Consistency with the full suite of California's motor vehicle emissions standards is necessary both to address Connecticut's own compelling and extraordinary conditions as well to comply with the CAA's prohibition on taking an action that would have the effect of creating a "third vehicle" standard,[12] and Connecticut's requirement to update the relevant regulations to maintain consistency with the California standards.[13]

Connecticut's Clean Vehicle Regulations Meet Federal and State Requirements

Motor vehicle standards that address greenhouse gas emissions as a regulated pollutant under the Clean Air Act and that support a shift to cleaner, more advanced technologies are within the scope of authority granted to California and the section 177 states, including Connecticut.[14] "The whole approach of the Clean Air Act is to force the development of new types of emission control technology where that is needed by compelling the industry to 'catch up' to some degree with the newly promulgated standard."[15]

As noted above, Connecticut satisfies the federal statutory criteria for adoption of the full suite of California emissions standards in that it faces significant air quality challenges and is in non-attainment for federal air quality standards, particularly for ground-level ozone.

The Connecticut General Assembly endorsed Connecticut's adoption of the Advanced Clean Cars and Low Emissions Vehicle programs (including necessary updates to remain in alignment with the California regulations) when it passed Public Act 04-84, which *requires* DEEP to adopt California's light-duty vehicle emissions standards and to update Connecticut's regulations as necessary to maintain consistency with the California standards.[16] Most recently, Public Act 22-25 expressly authorized DEEP to adopt California's medium-and-heavy duty vehicle standards.[17] The Connecticut General Assembly has had multiple opportunities to repeal the state's status as a section 177 state over the last several years (as the current regulations were being developed) and as has decidedly chosen not to so, further affirming the clear legislative intent to continue the state's leadership in addressing its air quality issues and improving public health through adoption of more stringent motor vehicle standards.

The Proposed Regulations are Feasible and Support Current Market Trends While Providing Additional Benefits for Customers

These regulations build on the requirements of the Advanced Clean Cars (ACC I) program, which has been successful in supporting the market transition to clean vehicles and ensuring that such vehicles are available to consumers who wish to purchase them. However, the ACC I regulations only apply to vehicles through model year 2025, so the current regulations are necessary to extend the program and ensure continued progress.

Existing Market Trends

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[9] RCSA § 22a-174-36.
[10] RCSA § 22a-174-36b.
[11] RCSA § 22a-174-36c.
[12] 42 U.S.C. § 7507.
[13] *See* Public Act No. 04-8, *An Act Concerning Clean Cars* (signed May 10, 2004); Public Act No. 22-25, *An Act Concerning The Connecticut Clean Air Act* (signed May 10, 2022).
[14] *See* Massachusetts v. EPA, 549 U.S. 497 (2007).
[15] 87 Fed. Reg. at 14342-14343.
[16] Public Act No. 04-8, *An Act Concerning Clean Cars* (signed May 10, 2004). It is worth noting that the bill passed by a vote of 143-1 in the House and 36-0 in the Senate.
[17] Sec. 15 of Public Act No. 22-25, *An Act Concerning the Connecticut Clean Air Act* (signed May 10, 2022).

In the instance case, the regulations align with where the industry is already headed and provide additional certainty with respect to the continued development of the EV market. Vehicle manufacturers have developed and released increasing numbers of both light duty and medium and heavy-duty electric vehicle models in recent years, and the EV market is experiencing exponential growth. According to the EIA, 14% of all car sales globally were EVs in 2022 (up from 9% in 2021 and less than 5% in 2020). In Europe, more than one in 5 cars sold was an EV in 2022 and Norway has achieved an 80% EV market share for new car sales. EV sales in the US increased 55% in 2022, reaching an annual market share of 8%,[18] with California reaching its goal of 21% EV sales two years ahead of schedule. In real numbers, the U.S. "is now the third largest EV market . . . the number of EVs on the road jumped from about 22,000 in 2011 to over 2 million in 2022."[19] In the first quarter of 2023, EV sales were up 60% relative to the same period last year.[20]

The number of zero-emission truck models has also continued to expand in 2022, with nearly 840 current and announced medium- and heavy-duty vehicle models in the Global Drive to Zero Emission Technology Inventory (ZETI) database.[21] Of commercially available bus and truck models in 2022 over 170 models were produced by North American manufacturers.[22]

Consumer Protection

While the market shift away from ICE vehicle to EVs is already well underway, Connecticut's proposed regulations provide additional consumer protection guarantees and incentives for manufacturers to provide low-cost vehicles, making EVs affordable for all customers. For example, the regulations require that all new vehicles delivered to the state be covered by certain ZEV assurance measures. These include minimum range durability requirements and enhanced battery warrant requirements.[23]

Affordability

Under the regulations, auto manufactures can receive extra program credit for providing discounted vehicles to community-based clean mobility programs and for bringing low-price EVs (not greater than $20,275 for a car or $26,670 for a light truck) to market.[24]

There are also existing federal and state financial incentives for the purchase of an electric vehicle. The Inflation Reduction Act (IRA) extends the federal $7,500 tax credit for the purchase of an EV through 2032. The IRA also established a $4,000 tax credit for used EVs (or 30% of the sales price, whichever is lower), and a new tax credit for commercial electric vehicles[25]. At the state level, Connecticut offers a cash incentive of $2,000 (with an additional $2,500 available for low-and-moderate income customers).

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[18] This figure is for the entire United States, including non-section 177 states.
[19] Sara Baldwin and Jack Conness, *Comparing the Cost to Travel: Electric vehicle Fill-Up Savings by State*, Energy Innovation Policy & Technology LLC, (Aug. 2023), https://energyinnovation.org/wp-content/uploads/2023/07/EV-Fill-Up-Savings-by-State.pdf.
[20] International Energy Agency, *Global EV Outlook 2023; Catching up with climate ambitions* (Apr. 2023), https://www.iea.org/reports/global-ev-outlook-2023
[21] International Energy Agency, *Global EV Outlook 2023; Trends in heavy-duty vehicles,* available at https://www.iea.org/reports/global-ev-outlook-2023/trends-in-electric-heavy-duty-vehicles.
[22] https://www.iea.org/reports/global-ev-outlook-2023/trends-in-electric-heavy-duty-vehicles.
[23] *See* The International Council on Clean Transportation, A*dvanced Clean Cars II: The next phase of California's Zero-Emission Vehicle and Low-Emission Vehicle regulations* 4-5 (Nov. 2022)
[23] *See* 87 Fed. Reg. 49 at 14364 -14366.
[24] *See* The International Council on Clean Transportation, A*dvanced Clean Cars II: The next phase of California's Zero-Emission Vehicle and Low-Emission Vehicle regulations* 5-6 (Nov. 2022)
[25] The commercial EV tax credit is $7,00 for vehicles under 14,000 lbs. GWV and up to $40,000 for larger vehicles.

At the same time, EVs cost less than conventional ICE vehicles to operate and maintain. A recent study has found that its cheaper to drive an EV than a gas-powered vehicle in every state in the U.S.[26] EVs also require far less maintenance than ICE vehicles due to fewer moving parts and avoiding the need for oil changes, etc. On average, maintenance costs for EVs are 40% lower than for their ICE counterparts.[27]

Domestic Manufacturing

The IRA also ties the federal tax credit to new requirements regarding the domestic manufacture and assembly of electric vehicle and batteries. One year after the IRA was passed, it has led to the creation of over 75,000 new jobs in the battery supply chain, with more than 190 new or expanded mineral, materials processing and manufacturing facilities, and resulted in over 80 new or expanded electric (EV) component or assembly plants in the United States.[28] In addition, the United States has seen growth in domestic battery recycling facilities,[29] and it is expected that battery recycling could meet up to 30% of nickel and 80% of cobalt usage in EVs by 2030.[30]

Finally, this growth in demand for EVs is being matched by investments in the charging infrastructure to support increased EV deployment. The Inflation Reduction Act provides a total of $7.5 Billion to building out the nation's EV charging network from 2022 to 2026.[31]

Adopting the Proposed Regulations will Result in Significant Environmental, Health and Economic Benefits for Connecticut

Adopting the proposed regulations is necessary for Connecticut to meet its clean air goals and individual greenhouse gas reduction obligations.[32] In Connecticut, the transportation sector accounts for 40% of Connecticut's greenhouse gas emissions,[33] and 66% of NOx emissions (a key component of ground-level ozone).[34] Cleaning up these emissions is particularly important for the health of low-and-moderate income populations living in our dense urban communities and

[26] Sara Baldwin and Jack Conness, *Comparing the Cost to Travel: Electric vehicle Fill-Up Savings by State*, Energy Innovation Policy & Technology LLC, (Aug. 2023), https://energyinnovation.org/wp-content/uploads/2023/07/EV-Fill-Up-Savings-by-State.pdf.
[27] Jim Groveland, "By The Numbers: What It Costs To Maintain An Electric Vehicle," Forbes (Oct. 6, 2022), https://www.forbes.com/sites/jimgorzelany/2022/10/06/by-the-numbers-what-it-costs-to-maintain-an-electric-vehicle/?sh=5987807564d3.
[28] U.S. Dept. of Energy, *The Inflation Reduction Act in Its First Year* (Aug. 15, 2023), https://www.energy.gov/articles/inflation-reduction-act-its-first-year; U.S. Dept. of Energy, *Battery Supply Chain Investments* (July 20, 2023), Investments in American-Made Energy | Department of Energy.
[29] Charles Morris, "IRA incentives set off battery recycling gold rush," Charged (July 25, 203), https://chargedevs.com/newswire/ira-incentives-set-off-battery-recycling-gold-rush/#:~:text=The%20voluminous%20Inflation%20Reduction%20Act,for%20the%20IRA's%20purchase%20incentives.
[30] Bruno Venditti and Miranda Smith, *Visualizing America's Electric Vehicle Future* (Jan. 20, 2022), https://www.visualcapitalist.com/sp/visualizing-americas-electric-vehicle-future/.
[31] White House, "Biden-Harris Administration Announces New Standards and Major Progress for a Made-in-America National Network of Electric Vehicle Chargers," (Feb. 15, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/02/15/fact-sheet-biden-harris-administration-announces-new-standards-and-major-progress-for-a-made-in-america-national-network-of-electric-vehicle-chargers/.
[32] Connecticut has committed to reducing its greenhouse gas emissions 45% by 2030 and 80% by 2050. Conn. Gen. Stat. § Sec. 22a-200a. Additionally, Connecticut has some of the worst air quality in the country according to the most recent report by the American Lung Association, https://www.lung.org/media/press-releases/state-of-the-air-connecticut.
[33] CT DEEP, *1990-2021Connecticut GHG Emission Inventory* 11 (2023).
[34] CT DEEP, *An Assessment of Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emissions Standards* 7 (2022), MHD_Whitepaper_030822.pdf (ct.gov).

along the state's major transportation corridors.[35] The Asthma and Allergy Foundation of America has ranked New Haven and Hartford as among the worst cities in the country for asthma (#5 and #17, respectively).[36]

Multiple analyses of the benefits of adopting both the Advanced Clean Cars II (ACC II) and Advanced Clean Truck (ACT) rule have been conducted, all demonstrating substantial benefits over a business as usual scenario.

Adopting ACC II would reduce total NOx and PM2.5 emissions in Connecticut by 580 and 39 tons/year, respectively.[37] A recent report by the American Lung Association found that if all new car sales were EVs by 2035, Connecticut would realize $11.5 billion in cumulative health benefits between 2020-2050, avoid 1,060 premature deaths, 22,900 asthma attacks, and 120,000 lost work days.[38] A study conducted by the international consulting firm EBP found that the economic and societal benefits of adopting the ACC II standards are "compelling and significant." Among the anticipated economic benefits are:

- $25.7 billion of value added to Connecticut's GDP
- $40.1 billion increase in net business income
- 128,200 net new job-years in CT[39]

In addition to the economic and health benefits, adoption of ACC II would result in the avoidance of 137 million metric tons of CO_2 emissions, the equivalent of planting 3.5 billion trees.[40] The anticipated reduction in emissions form criteria and climate pollutants is expected to deliver improvements across twenty-four personal and societal metrics including human health, productivity, social equity, food and water security, biodiversity, and mitigation of natural disasters such as wildfires and flooding.[41]

The Advanced Clean Truck (ACT) standards will result in annual reductions of ground-level ozone pollutants of between 2,600 to 3,300 tons a year, and cumulative reductions in greenhouse gas emissions of nearly 1.5 million metric tons.[42] The Department of Energy and Environmental Protection has estimated that these standards "could save Connecticut residents more than $271 million in healthcare costs by 2040."[43] By 2050, cumulative savings in healthcare costs are estimated at $413 million.[44]

Connecticut Climate Impacts

Connecticut, like California, is particularly impacted by climate change. Among the climate-related impacts that Connecticut faces are:

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[35] *See* California Air Resources Board, "California takes bold step to reduce truck pollution: First-of-its-kind requirement for electric trucks will help communities hardest hit by air pollution" (June 25, 2020) https://ww2.arb.ca.gov/news/california-takes-bold-step-reduce-truck-pollution.

[36] Asthma and Allergy Foundation of America, *Asthma Capitals 2021: The Most Challenging Places to Live with Asthma* at 6 (May 2021), available at https://www.aafa.org/media/3040/aafa-2021-asthma-capitals-report.pdf.

[37] International Council on Clean Transportation, Benefits of Adopting California's Advanced Clean Cars II (ACC II) Standards in Connecticut (May 2023), ct-acc-ii-benefits-fs-may23.pdf (theicct.org).

[38] American Lung Association, Driving to Cleaner Air: Health Benefits of Zero-Emission Cars and Electricity (June 2023), Driving to Clean Air: Health Benefits of Zero-Emission Cars and Electricity (lung.org).

[39] EBP, *Connecticut Electric Vehicle Policy Impacts Study* 4-5 (Apr. 2023), Connecticut Electric Vehicle Policy Impact Study (savethesound.org).

[40] EBP, *Connecticut Electric Vehicle Policy Impacts Study* 4-5.

[41] EBP, *Connecticut Electric Vehicle Policy Impacts Study* 38-40.

[42] CT DEEP, *An Assessment of Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emissions Standards* 16 (2022).

[43] CT DEEP, *An Assessment of the Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emission Standards* 17 (2022).

[44] CT DEEP, *An Assessment of the Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emission Standards* 17 (2022) Other estimates are as high as $1.4 billion. *Id*. at 18.

- **Sea Level Rise:** 91% of CT's population live or work in communities prone to flooding. CT has experienced a six-inch rise in sea level in the last 50 years (higher than current global rates), and sea level is expected to rise an additional 1.5 feet by 2050.[45]
- **Extreme Heat Days:** Connecticut has some of the worst air quality in the country, with Hartford, Bridgeport, and New Haven among the top cities where it is most challenging to live with asthma.[46] Temperature in CT is rising faster than the global average[47]—impacting the health of children, the elderly, and those with respiratory issues such as asthma.
- **Increasing Storms:** Over the last decade, storms have left more than 2 million CT customers without power and caused more than $3 billion in statewide damage.[48]

Recognizing the specific state-level adverse impacts that climate change pose for Connecticut, the state has adopted greenhouse gas reduction targets, with a goal of reducing such emissions 45% by 2030 and 80% by 2050. It is critical to reach these targets in order to protect our environment, public health, and economy form the worst consequences that a changing climate threatens. The U.S. EPA has determined that the nexus between GHG emissions regulation and criteria pollutant emissions satisfies the necessary showing of compelling circumstances to adopt more stringent vehicle emissions standards that address climate-related emissions.[49]

Connecticut is not Acting Alone

In proposing to adopt these updated regulations, Connecticut joins a growing number of states around the country that have already adopted these latest regulations or in the process of doing so. Currently, 17 states, including Connecticut, follow California's more stringent emissions standards pursuant to the federal grant of authority under the Clean Air Act. This group of states accounts for more than 40% of new vehicle sales.[50] Seven states have already adopted the updated ACCII standards (California, Washington, Oregon, Massachusetts, New York, Virginia, and Vermont) and five more states have begun the process of adopting these standards.[51] Eight states have already adopted the ACT rule: (California, Oregon, Washington, Massachusetts, Vermont, New York, New Jersey, and Colorado), while two more are in the process of adopting the requirement.[52]

Acting in concert with our neighboring jurisdictions multiplies the benefits that can be derived from the proposed regulatory requirements. This is particularly true in the case of climate impacts, as the states working to adopt these standards represent a significant portion of the population of the United States, as well as of the motor vehicle market.

Conclusion

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[45] CT DEEP, *Connecticut: Our Changing Climate* 6 (Aug. 2020), CT-Changing-Climate-Booklet.pdf.
[46] Asthma and Allergy Foundation, *Asthma Capitals 2022* at 9 (2022), AAFA 2022 Asthma Capitals Report September 2022.
[47] UMASS Amherst, *How will global warming of 2°C affect Connecticut?: Observed and projected changes in climate and their impacts* (Apr. 26, 2016), https://www.geo.umass.edu/climate/stateClimateReports/CT_ClimateReport_CSRC.pdf.
[48] *See* Ten Year Anniversary of Super Storm Sandy (UCONN Connecticut Institute for Resilience & Climate Adaptation (CIRCA) (Nov. 7, 2022); A decade after Superstorm Sandy, one resident recalls costs to Connecticut's coast (CT Public Radio Oct. 27, 2022); One Year Later: The Lasting Impacts of Tropical Storm Isaias (NBC CT Aug. 4, 2021); Tropical Storm Irene 1 year later: Greater New Haven towns rebuild, but pain lingers (NH Register Aug. 25, 2012); 2011 Halloween nor'easter (Wikipedia) ("At a November 1 press conference, Governor Malloy estimated that damages in Connecticut would exceed $3 billion. Two days later, close to 700,000 homes and businesses remained without power. A week after the storm, almost 150,000 customers of the state's two utilities had not yet had power restored.").
[49] *See* 87 Fed. Reg. at 14364 -14366.
[50] California Air Resources Board, *States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act* (May 13, 2022), https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177_states_05132022_NADA_sales_r2_ac.pdf.
[51] CalStart & Ceres "Companies applaud as five states take action to bring more clean cars and trucks to their roads" (2023), https://calstart.org/companies-applaud-five-states-for-acc-act-rules-action/#:~:text=If%20all%20five%20states%20finalize,of%20adopting%20the%20ACCII%20rule.
[52] *Id.*

The standards are essential to meeting the needs of Connecticut in addressing pressing air quality, health, and environmental issues facing the state. By adopting these standards Connecticut is following the path set out in the federal Clean Air Act, as well as the express will of the General Assembly.

We urge DEEP to finalize the regulations with all deliberate speed to ensure that Connecticut's residents enjoy the full benefits of these incredibly important standards when they go into effect.

Thank you for the opportunity to provide these comments.

Respectfully submitted,

/s/ Charles J. Rothenberger
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CONNECTICUT ELECTRIC VEHICLE POLICY IMPACT STUDY

2023 REPORT PREPARED FOR SAVE THE SOUND

BASED ON DATA AVAILABLE IN 2022

EBP

Contents

Executive Summary

This report examines expected economic impacts from transitioning Connecticut's motor vehicle markets from fossil fueled Internal Combustion Engine (ICE) vehicles to a fleet of alternatively fueled vehicles, such as electric vehicles. This transition will achieve substantial reductions in greenhouse gas and criteria pollutant emissions, producing significant public health benefits and an energy-efficient economy. The Connecticut transportation transformation will result in changes in the state's economy, providing opportunities for economic development while adjusting the make-up of jobs and professions that serve the transportation industry. The analysis examines the market from several perspectives to provide Connecticut stakeholders with clearer expectations of how the economy will change as a result of the transition to clean electric vehicles, and what the changes will mean for Connecticut.

Connecticut is not undertaking this transformation alone. The state is one of a group of 18 states, including California, developing and following complementary pathways to achieve greatly reduced vehicle emissions. California's development of, and investment in, emission-reduction policies and protocols set the overall direction, with early participation by Connecticut, Massachusetts, and New York, among others. Each of Connecticut's neighboring states, Rhode Island, Massachusetts, New York and other states in New England, the Mid-Atlantic, and other regions are following these pathways, structuring them to best serve their state's particular environment and needs within common frameworks. To assist readers, the report shows how four states are working to integrate Zero-Emission Vehicles (ZEVs) and the infrastructure needed to support a transition to Battery Electric Vehicles (BEVs), Plug-In Hybrid Electric Vehicles (PHEVs), and Fuel Cell Electric Vehicles (FCEVs).

Background

California has recently updated its motor vehicle emissions regulations with the adoption of the Advanced Clean Cars II (ACC II) regulations. These regulations require that an increasing percentage of light-duty vehicles sold in the state be zero-emission vehicles (ZEVs), with a goal that by 2035 all new passenger cars, trucks and SUVs sold in the state will be zero emissions.[1, 2]

ACC II includes compliance flexibilities that make it easier for auto manufacturers to meet the state's goals. These include credits for complying before ACC II takes effect; complying with ACC I; and expanding access to ZEVs in low-income communities.[3] The flexibilities also include the

[1] Advanced Clean Cars II, California Air Resources Board, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii.
[2] The California Air Resources Board approved the Advanced Clean Cars II Regulations, including the Zero Emission Vehicle Standards for 2026 and Subsequent Model Year Passenger Cars and Light-Duty Trucks, on August 25, 2022.
[3] Kathy Harris, *Clean Car Rules: What they Mean for States*, NRDC (October 5, 2022), https://www.nrdc.org/experts/kathy-harris/clean-car-rules-what-they-mean-states.

ability to transfer credits from states with high ZEV sales to states with lower sales, as well as an allowance for fuel cell vehicles.

The proposed ACC II policy is intended to drive the sales of ZEVs while reducing smog-forming emissions from new internal combustion engine (ICE) vehicles.[4] These standards are intended to reduce pollution from conventional vehicles, improve public health, and accelerate the transition to zero-emission vehicles, which will have the added benefit of reducing the total cost of ownership for passenger cars and light trucks, saving drivers money and further supporting consumer adoption of electric vehicles.[5] Connecticut is one of 17 states that have opted to follow California's vehicle emissions regime, rather than the less stringent federal standards. As such, Connecticut now has the opportunity to join with California, Massachusetts, New York, and other states in adopting the ACC II standards.

Connecticut's transportation sector is the largest contributor of greenhouse gases (GHG) in the state, accounting for 37.4 percent of total state emissions, approximately twice any other sector.[6] Connecticut also suffers from some of the worst air quality in the country, with New Haven and Hartford in the top 20 of U.S. cities where it is most challenging to live with asthma.[7] Mobile source pollutants such as nitrogen oxides (NO_x) contribute to smog formation and poor air quality, exacerbating other chronic respiratory problems such as Chronic Obstructive Pulmonary Disease (COPD) and other lung diseases.[8]

The Governor's Council on Climate change (GC3) and the Department of Energy & Environmental Protection (DEEP) have identified transportation electrification as one of the primary strategies to improve air quality and to achieve the state's economy-wide greenhouse gas (GHG) reduction targets, as required by the Global Warming Solutions Act (GWSA), of 45 percent below 2001 levels by 2030, and 80 percent by 2050.[9] Adoption of ACC II is critical to increasing ZEV penetration rates to help meet Connecticut's public health and climate goals and state and federal air quality standards. There are 25,444 EVs registered in Connecticut as of July 1, 2022,[10] which is 5.1 percent of the state goal of 500,000 ZEVs by 2030.[11] The ZEV market share of Connecticut new light-duty vehicle sales for the first two Quarters of 2022 was 6.83 percent, up from 2.36 percent

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[4] In addition to the ZEV standards, the ACC II regulations update and revise vehicle engine emissions standards for NMOG and NO_x, CO, and particulate matter (PM). Final Regulation Order: Adoption of new Section 1961.4, Title 13, California Code of Regulations. Connecticut may adopt California's engine and motor vehicle emission standards under Section 177 of the Clean Air Act, 42 U.S.C. § 7507.

[5] California Air Resources Board Public Hearing to Consider the Proposed Advanced Clean Cars II Regulations (April 2022), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/isor.pdf.

[6] Connecticut Department of Energy and Environmental Protection, *2018 Greenhouse Gas Emissions Inventory* (2021), https://portal.ct.gov/-/media/DEEP/climatechange/GHG_Emissions_Inventory_2018.pdf.

[7] Asthma and Allergy Foundation of America, *Asthma Capitals 2021*, https://www.aafa.org/media/3040/aafa-2021-asthma-capitals-report.pdf.

[8] Connecticut Department of Energy and Environmental Protection, *Electric Vehicle Roadmap for Connecticut* (2020), https://www.dpuc.state.ct.us/DEEPEnergy.nsf/c6c6d525f7cdd1168525797d0047c5bf/f7ed4932eec438d0852585520001c81b/$FILE/EV%20Roadmap%20for%20Connecticut.pdf.

[9] Connecticut General Statute § 22a-200a.

[10] Connecticut Department of Energy and Environmental Protection, *EV Registration Fact Sheet*, https://portal.ct.gov/-/media/DEEP/air/mobile/CHEAPR/2022-07-01---Expanded-EV-Reg-Fact-Sheet.pdf.

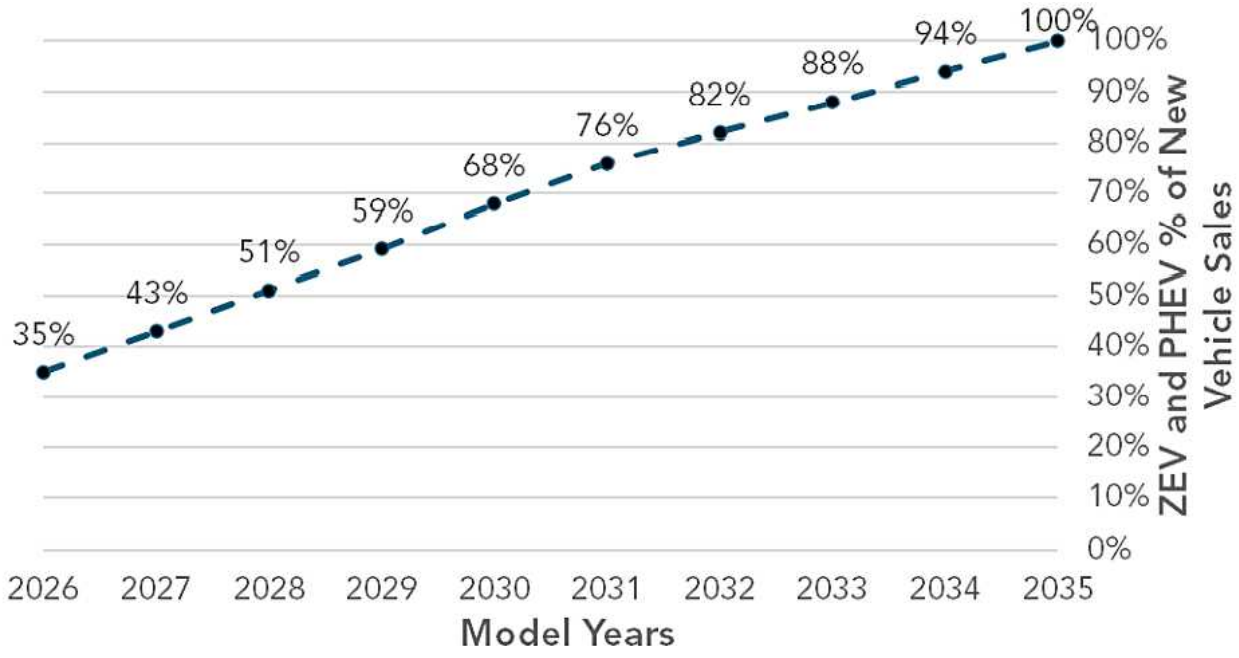
[11] Connecticut Department of Energy and Environmental Protection, *Electric Vehicle Roadmap for Connecticut*, (2020).

in 2020.[12] The Connecticut Hydrogen Electric Automobile Purchase Rebate (CHEAPR) program has recently had its annual funding increased from $3 million to $8 million annually, which will help to support achieving the state's ZEV goal.[13] Beginning in 2023, an additional estimated $5 million from the Regional Greenhouse Gas Initiative (RGGI), will be dedicated to the CHEAPR program.[14]

ZEVs provide multiple benefits to Connecticut drivers, including lower maintenance and fuel costs, as well as broader benefits to the state, including net positive economic impacts and numerous societal co-benefits of avoided emissions.

The ACC II policy will significantly reduce emissions from light-duty passenger cars, trucks, and SUVs. The ACC II policy requires ZEVs to constitute an increasing percentage of new car sales, starting with the 2026 model year at 35 percent, progressing to 68 percent in 2030 and to 100 percent in 2035, as shown in Figure 1 below.

Figure 1. Proposed Annual ZEV Sales Attainment



Source: California's Proposed Advanced Clean Cars II Regulations.

Under California's complementary Advanced Clean Truck (ACT) rule, starting in 2024, ZEV sales goals for Medium and Heavy-Duty trucks are set to ramp up to 30 to 50 percent by 2030, depending upon the specific vehicle weight class, and between 40 and 75 percent by 2035. It is

[12] Alliance for Automotive Innovation quarterly reports, https://www.autosinnovate.org/posts/papers-reports/Get%20Connected%20EV%20Quarterly%20Report%20Q4.pdf.
[13] Public Act 22-25, *An Act Concerning The Connecticut Clean Air Act* (May 10, 2022), https://www.cga.ct.gov/2022/act/pa/pdf/2022PA-00025-R00SB-00004-PA.pdf.
[14] *Id*.

likely at this point that electricity will be the fuel of choice for most medium and many heavy-duty trucks that are used for local or short haul trips. Hydrogen appears to be the better solution for long haul trips, but this is highly dependent on the fuel cost of green hydrogen and the real-world total cost of ownership and operation, considering actual costs for several types of battery electric and fuel cell vehicles in multiple usage patterns, such as long-haul versus local uses.

Summary of Findings

This study provides an objective analysis of future impacts for Connecticut's economy, as well as broader societal benefits to be expected with the transition to electric vehicles. The primary conclusion from the study is that economic impacts and societal benefits are compelling and significant, and that failure to adopt the policy would jeopardize achieving Connecticut's public health, clean air, and emission reduction goals.

Connecticut has a major opportunity to benefit economically from a transition to EVs. The proposed policy will support increased EV adoption, which will generate positive economic impacts for individuals, households, manufacturers, energy suppliers and various equipment maintenance services throughout the state. Connecticut can also grow its economy beyond direct effects of EVs by capitalizing on new economic development opportunities around EV-related technologies such as energy storage, electrical components manufacturing, and charging station design and manufacturing.

Estimated net economic impacts, benefits and avoided emission costs attributable to adopting ACC II are in Table 1. Economic impacts represent changes in the flow of money in the Connecticut economy, whereas societal benefits have economic value in terms of avoided costs.

Table 1. Estimated Net Economic Impacts, Benefits and Avoided Emission Costs from Connecticut's Light-Duty Vehicles, 2022-2050 (29-Year Total in Billions of Constant 2021 Dollars)

Economic Impacts and Societal Benefits from Connecticut 100% EV Sales Policy	Value of Benefits and Impacts (Billions)
Added Net Business Income (Economic Impact)	$40.1
Value Added (GDP) Growth in Connecticut (Economic Impact)	$25.7
Value of Criteria Pollutant Emission Reductions (Societal Benefits - Local)	$4.4
Value of Carbon Emission Reductions (Societal Benefits – Global)	$27.1

Table 2 highlights key findings and conclusions that call out the economic impacts and societal benefits of the 100 percent EV sales policy between 2022 and 2050.

Table 2. Key Conclusions, 29-Year Effect from 2022-2050 (Billions of Constant 2021 Dollars)

Key Conclusions
$40 billion in net business income (economic impact).
$26 billion in net value added or GDP (economic impact).
128,200 net new job-years, representing about 4,400 more jobs than would otherwise exist each year.
$4 billion in value of criterial pollutant emission reductions (societal benefits - local).
$27 billion in value of carbon emission reductions (societal benefits - global).
$42 billion in gross vehicle fuel cost savings.
$15 billion in gross vehicle operating and maintenance cost savings.
Carbon emission reductions of 137 million metric tons CO_2.
Carbon emission reduction equivalent of planting 3.5 billion trees.
Improved air quality from pollution emission reductions of NO_x (68,681 metric tons), SO_2 (796 metric tons), PM2.5 (3,418 metric tons), and VOCs (81,080 metric tons)
The policy will unlock new opportunities for economic development around EV-related technologies.
The policy will ensure Connecticut stays economically competitive by capturing market share in EV-related industries sooner than other states.
Failure to adopt the ACC II policy would jeopardize achieving Connecticut's public health, clean air, and emission reduction goals.
Due to the EV content provisions of the Inflation Reduction Act, full implementation is likely to be slowed, making Connecticut's state-level incentives even more important in the current and near-future EV transition.

Note: The net impact accounts for losses in income, whereas gross impacts account for gains only.

This report consists of seven sections.

- **Introduction**. Highlights Connecticut's work as one of the original ZEV sponsors. It then describes EBP's approach and methods to develop an objective analysis tailored to the specific circumstances in Connecticut, including the primary economic drivers, impacts on workers, income, and the overall economy.
- **Interviews.** To help in guiding the economic analysis EBP interviewed eleven leading professionals from a variety of perspectives including, business, manufacturing, economic development, environmental policy, and three state governments.
- **Background Research.** To provide a full context, EBP researched a number of critical factors, their history and relevant technology and economic concerns, including a comparison of key EV and charging infrastructure goals, programs, and achievements.

Discussion of the Inflation Reduction Act and its likely impact on ZEV adoption in Connecticut, and a discussion of the applicability of hydrogen fuel-cell vehicles (FCEVs) in the coming decade, is also included.

- **Economic Analysis.** EBP conducted an economic analysis, reporting on key metrics, including energy dollars kept in state, business growth and development, long term cost savings to residences and businesses, broader job and income growth within Connecticut and tax revenue impacts for state and local government, resulting from the analysis findings within the overall topics of electric vehicle forecast, economic impacts, economic development opportunities, other opportunities, and costs of inaction.
- **Economic Value of Societal Benefits.** EBP conducted an analysis of carbon and criteria pollutant emission reductions, societal benefits, and monetization of the societal benefits of avoided emissions.
- **Medium and Heavy-Duty Trucks.** Examines Connecticut's ZEV policy determinations and actions regarding medium and heavy-duty trucking and then reports on a 2022 study by the National Renewable Energy Laboratory that analyzed economic considerations of vehicles by type, size, uses and miles traveled to estimate the optimal fuels for each case studied.
- **Key Conclusions.** Observations and conclusions from the qualitative and quantitative report results.

Acknowledgements

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Introduction

Connecticut has a history of leading on clean transportation, as one of the original ZEV state members, and home to the nation's first point-of-sale EV rebate program, the Connecticut Hydrogen and Electric Automobile Purchase Rebate program (CHEAPR). The state also has the benefit of a robust and active EV stakeholder coalition, the Connecticut EV Coalition, a group of environmental organizations and businesses that work together to advance policies that will build out electric vehicle infrastructure and put more electric vehicles on the road in Connecticut to achieve economic, health, and climate benefits.[15]

Save the Sound, convener of the Connecticut EV Coalition, has directed EBP to conduct this economic impact and societal benefits study to provide an objective analysis of future impacts and benefits for the Connecticut economy, as well as the broader societal benefits to be expected with the adoption of the 100 percent EV sales policy.

Approach

The study involved five primary components: 1) Stakeholder interviews, 2) Background research, 3) Economic analysis and modeling, 4) Societal benefits analysis and modeling, and 5) Development of key messaging.

The EBP team conducted nine interviews with key Connecticut EV and economic development stakeholders to ascertain the most important issues to stakeholders and obtain qualitative insights from stakeholders in various parts of the Connecticut EV ecosystem. Background research was performed to help set the stage for the economic impact and societal benefits analysis, including a comparison of leading state's decarbonization and EV transition plans, auto manufacturer's plans for electrifying their product lines, an examination of the recently enacted federal Inflation Reduction Act (IRA), and a brief look at hydrogen fuel cells.

The economic analysis began with development of alternative EV adoption forecasts for Connecticut, representing scenarios with and without the ACC II policy in place. A statewide economic model was utilized to assess the magnitude of direct effects on changes in household and business revenues and expenditures, and broader impacts on income, supply chains, business investment and consumer spending In Connecticut. The modeling incorporated insights from key stakeholder interviews regarding Connecticut's economic development and energy development opportunities and expectations.

The examination of the economic value of societal benefits was based on the EV forecasts and accepted emission factors for five key pollutants: carbon dioxide (CO_2), particulate matter (PM2.5), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and volatile organic compounds (VOCs).

[15] Connecticut Electric Vehicle Coalition, https://www.savethesound.org/what-we-do/climate-resiliency/cleaner-transportation/connecticut-electric-vehicle-coalition/.

Following a qualitative discussion of the individual and societal benefits of emission reductions, the report presents a monetization of the societal benefits using a social cost of carbon (SCC) approach.

The brief section on medium and heavy-duty trucks is followed by the concluding section that highlights the total value of economic impacts and societal benefits, and key conclusions that highlight the benefits that will accrue to the State of Connecticut and its residents by adopting the ACC II EV policy.

Interviews

EBP interviewed several knowledgeable Connecticut stakeholders from a variety of perspectives, including governmental agencies covering two states and a regional planning organization, EV advocates, and the largest Connecticut electric and gas utility, who have been in the forefront of the EV transition. They also included officials of statewide economic development and technology development agencies. The qualitative data developed from interviews guided the project research and economic analysis work, ensuring the project outputs are on-target.

Interview Topics

- Goals for EV adoption, factors working for and against reaching goals
- Primary policy and regulation issues, including coordination among state government players and programs
- Effective messages that will move the public and stakeholders to advance EV transition
- Equity issues in EV purchase and charging availability
- Useful studies and other references

Table 3 shows the list of interviewees.

Table 3. List of Interviewees

Name	Affiliation
Kevin Boughan, Brian Morrissey	Eversource
Ted Fisher	Director of Business Development, AdvanceCT
Eric Friedman	Massachusetts Department of Energy Resources
Jeremy Hunt	Northeast States for Coordinated Air Use Management (NESCAUM)
Barry Kresch	Connecticut EV Coalition
Paul Lavoie	Chief Manufacturing Officer, State of Connecticut (DECD)
Joel M. Rinebold	Director of Energy, Connecticut Center for Advanced Technology
Adam Ruder	New York State Energy Research & Development Authority (NYSERDA)
Rudy Stark, Eric Shrago	Connecticut Green Bank

Interview and Related Insights

EBP interviewed 11 knowledgeable individuals to assist in guiding the economic analysis, and also explored several of the identified issues such as the attraction of EVs for consumers, concerns about vehicle charging and range, high purchase costs compared to ICE vehicles, as well as early trends of fleet owner adoption.

Consumers want to purchase EVs. In early 2022, Consumer Reports interviewed 8,000 consumers in a national representative survey. They found high awareness of EVs, varying by demographic groups, including perceptions by 70 percent that EVs are an environmental issue, 31 percent indicating an interest in buying or leasing EVs, and 14 percent declaring they would definitely buy or lease an EV as their next car. Consumers cited the advantages of fueling with electricity as opposed to gasoline, expected fewer repairs, and were more likely to purchase an EV if they had driven or ridden in one. Concerns were expressed about range, charging, and high purchase costs, similar to the results of other surveys.[16]

Status of EV adoption. States are adopting goals to increase the deployment of electric vehicles, ultimately looking to reach 100 percent of new car sales. Actual sales have lagged expectations but are on the rise since 2021, against a backdrop of recent and on-going barriers, including the lingering impact of the COVID 19 pandemic, supply chain delays and disruptions, especially in microprocessors but affecting other key materials as well, leading to fewer available EVs. EV sales have increased largely in the higher priced vehicle segment. Two commenters noted that few potential EV buyers have the opportunity to test drive EVs because of scarcity of accessible cars at dealers, as well as concerns about insurance at community events. One commenter also believes there is too much emphasis in EV advertising on vehicle range since most daily usage of light-duty vehicles is short enough in mileage and duration to be satisfied by any EV currently on the market, and most earlier models that had much shorter range.

Despite the barriers, EV market penetration has increased beyond 5 percent in Connecticut and other leading states in the region. This milestone is important, say market observers such as Bloomberg, because sales beyond 5 percent of the total vehicle market means that EV buyers are no longer just early adopters.[17] Bloomberg assumes the EV market penetration curve will be similar to other significant consumer goods, indicating that the rate of EV market penetration will increase dramatically from this point. Market penetration will be further spurred by the broadening and deepening of incentives under the bipartisan Infrastructure Investment and Jobs Act (IIJA)[18] that will bring approximately $52 million to Connecticut for EV infrastructure investment, and the just passed federal Inflation Reduction Act (IRA) of 2022 which will provide

[16] Consumer Reports, *BEV and LCF Survey* (February 2022), https://article.images.consumerreports.org/prod/content/dam/surveys/Consumer_Reports_BEV%20AND%20LCF%20SURVEY_18_FEBRUARY_2022.

[17] Tom Randall, *U.S. Crosses Electric Car Tipping Point for Mass Adoption*, Bloomberg (July 9, 2022), https://www.bloomberg.com/news/articles/2022-07-09/us-electric-car-sales-reach-key-milestone?leadSource=uverify%20wall.

[18] https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf.

further resources. The IRA also adjusts the incentive structure to include a variety of direct incentives that can be transferred to dealers, rather than limiting federal incentives to tax incentives only, which should help to reduce the initial purchase price barrier.

Commercial fleet adoption. Commercial fleets may be adopting EVs much more quickly than initially estimated. A 2021 article notes 21 companies switching to electric fleets, including corporations such as Amazon, Comcast, Fed Ex, Hertz, Ikea, and Waste Management,[19] both because of environmental concerns and total costs of ownership. Figure 2 on page 12 graphically describes the total cost of ownership for both consumer and common delivery trucks, showing increasing favorability over time as technological and other factors such as reduced costs of maintenance and fuel come into effect.

Affordability. The EV market is rapidly evolving. Studies such as the 2021 Argonne National Laboratory Cost of Ownership study[20] demonstrate that over time levelized total costs of EV purchase, taxes, insurance, operation, and maintenance will become steadily less than ICE vehicles. However, the first cost of EVs is currently significantly higher than comparable ICE vehicles, constituting a substantial barrier for middle- and lower-income consumers. Without incentives in the form of federal tax credits, state rebates, and other incentives for some years to come, the EV market would not transform at the needed pace and a major means of reducing carbon emissions would be compromised. State initiatives like the CHEAPR program[21] are a vital element to moving EV markets beyond the current national new vehicle market share of six percent.[22]

Incentive programs need to be regularly evaluated to ensure they are effective in stimulating the target markets and are cost-effective. A study by the Commonwealth of Massachusetts[23] indicates that EV incentives are cost effective, but that there are free riders among the higher priced vehicle purchases. Some adjustments to incentives and additional mechanisms to attract medium- and lower-income consumers may be in order. Inclusion of used EVs in incentive programs may be an important aspect of broadening the market. Connecticut has recently increased and broadened incentives under the CHEAPR program to include increased incentives for medium- and lower-income customers, including for used vehicles. Other state programs, such as Massachusetts' MOR-EV program, are also considering similar incentive adjustments. At the national level, the Inflation Reduction Act has established federal incentives for the purchase of used vehicles for the first time, which should further help to expand access to EVs for lower- and middle-income customers.

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[19] Christine Lellis, *These 21 Companies Are Switching to Electric Vehicle Fleets*, Perillon.com (October 26, 2021), https://www.perillon.com/blog/21-companies-switching-to-electric-vehicle-fleets.

[20] Argonne National Lab, *Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains* (April 2021), https://publications.anl.gov/anlpubs/2021/05/167399.pdf.

[21] https://portal.ct.gov/DEEP/Air/Mobile-Sources/CHEAPR/CHEAPR---Home.

[22] Cox Automotive Inc., *EV Sales Hit New Record in Q2 2022* (July 13, 2022), https://www.coxautoinc.com/market-insights/ev-sales-hit-new-record-in-q2-2022/.

[23] Massachusetts Department of Energy Resources, *MOR-EV Cost-Effectiveness Study & Next Phase of Program*, (April 15, 2022), https://www.mass.gov/doc/zev-commission-april-15-2022-mor-ev-cost-effectiveness-study-next-phase-of-program/download.

Effective Messages. Interviewees for this analysis raised concerns that among consumers many potential EV customers are not knowledgeable about EVs and do not fully understand the financial benefits of available tax and rebate incentives. Consumers see high prices that look unaffordable. They are also concerned about vehicle range and the availability of charging stations when they take long drives.

The U.S. Department of Energy information Administration reports that 60 percent of all car trips were less than six miles, with daily mileage estimates ranging from 35-41 miles per day.[24] Based on these statistics, some interviewees believe the range concerns are unwarranted for most of daily driving. However, consumers want vehicles that can satisfy all of their driving needs.

PHEV's currently can drive all-electric for 20-55 miles on a full charge, satisfying most daily driving needs in all-electric mode.[25] Auto makers emphasize that PHEVs actual total range can be 500 miles or more, with the combination of electric and ICE driving, which can reduce consumers' range anxiety. Additionally, even a relatively inexpensive fully electric EV such as the Chevy Bolt has a range in excess of 200 miles on a single charge.[26] As BEV range increases and fast charging infrastructure grows, range anxiety should decrease.

EV's that currently dominate the market don't look affordable to many consumers, a circumstance that the California ZEV regulations look to address by providing additional compliance credits to manufactures that offer lower-priced ZEVs for sale. The first-cost barrier is real and not just for lower income consumers. Emphasizing total cost of ownership is good economic reasoning but messaging that explains the real package costs of EV purchases or leases when combined with available incentives needs to be improved.

There are also concerns about public charging availability and reliability. Most EVs are currently charged at home or at work.[27] However, while the number of public charging stations is growing rapidly, their reliability is a matter of concern. J.D. Power conducts quarterly surveys on public charging. They find that, while consumers like and understand the EV charging process and are comfortable with it, there is a lot of concern about the reliability of public charging equipment in place. According to J.D. Power, "charging station availability is a top barrier to the greater adoption of electric vehicles (EVs) as perceived by U.S. consumers today."[28] Morning Consult, a decision intelligence group, suggests the following based on their market research.

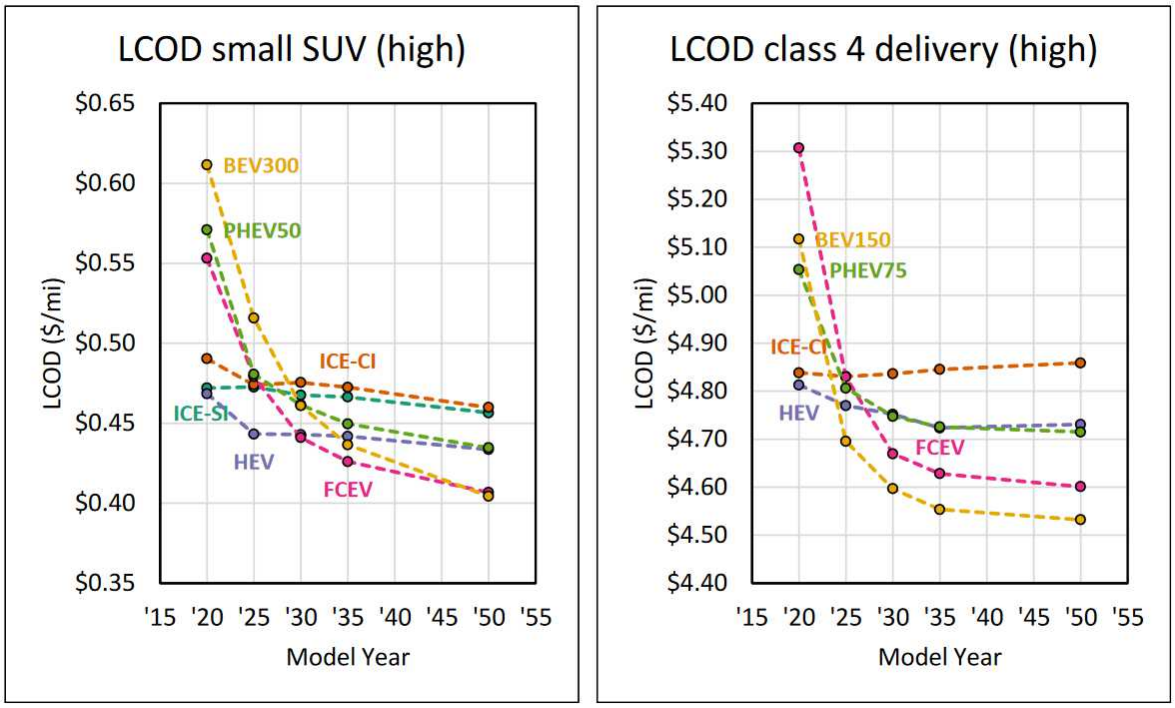
> "Looking ahead, EV manufacturers should connect with EV-interested consumers through persistent brand messaging. We know from our 2022 Super Bowl research that EV-interested consumers have shown consistently higher ad favorability and recall, and not

[24] U.S. Department of Energy, FOTW #1042 (August 13, 2018), *In 2017 Nearly 60 percent of All Vehicle Trips Were Less than Six Miles*, https://www.energy.gov/eere/vehicles/articles/fotw-1042-august-13-2018-2017-nearly-60-all-vehicle-trips-were-less-six-miles.
[25] Drive Clean, *Plug-in Hybrid Electric Cars*, https://driveclean.ca.gov/plug-in-hybrid.
[26] www.fuel econcomy.gov, https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=45751 (visited December 1, 2022).
[27] U.S. Department of Energy, Alternative Fuels Data Center, *Charging Electric Vehicles at Home*, https://afdc.energy.gov/fuels/electricity_charging_home.html.
[28] J.D. Power, *Release on Public Charging quarterly survey results Electric Vehicle Experience (EVX) Public Charging Study*, https://www.jdpower.com/business/automotive/electric-vehicle-experience-evx-public-charging-study.

> just with messaging from automotive companies focused on EVs. At the same time, the EV-hesitant audience is still highly nuanced. Manufacturers should draw them in not only by addressing price and supply issues, but also by offering relevant education and community outreach programs."[29]

Total Cost of Ownership. The Argonne National Laboratory report cited above, compared costs, such as purchase price, taxes and fees, insurance, financing, fueling, maintenance, and repair for projected 2025 model year ICE and ZEV vehicles. Argonne then developed levelized total costs for each vehicle type studied. Figure 2 shows the levelized (all) costs for small SUVs and delivery vehicles through 2055. Incentives are not included in the analysis because they are a mechanism to increase demand rather than recover costs.[30]

Figure 2. Levelized costs of two vehicle types assuming technological and other cost improvements[31]



Note: Figure 4.7 from Argonne National Laboratory Report

There are Economic Development Opportunities for Connecticut in the EV Transition. Connecticut's economy includes technology industries spanning aerospace and marine transportation products, electronic controls and software, and renewable energy production and storage. These current industries and the advanced technology training of the state's workforce

[29] Lisa Whalen, *In the American EV Market, What Drives the Interested and Holds Back the Hesitant?*, Morning Consult (May 4, 2022), https://morningconsult.com/2022/05/04/american-ev-market-interest/.
[30] *Supra*, note 20 at 136.
[31] The designations ICE-CI and ICE-SI refer to conventional internal combustion engine vehicles with compression ignitions or spark ignitions, respectively.

can be leveraged to support and gain economic growth from the transition to electric vehicles. Conversely, Connecticut has a smaller position in industries related to petroleum products and related automotive engine parts, so the state has limited exposure to future shrinkage in these industries. This creates opportunities for the state to grow and attract new economic activity associated with expansion in demand for electric vehicles. However, for opportunities to be fully realized, there needs to be a coordinated and sustained economic development strategy that builds upon these opportunities. A discussion of economic development opportunities is found in the Economic Analysis section of this report.

Background Research

Leading State's Decarbonization/Electric Vehicle Plans

This report section deals with legal, legislative and regulatory history, current incentives in four states for EV rebates and charger support, discussion of the Inflation Reduction Act and aspects of it that may impact the role of federal rebates in the rate of EV adoption in Connecticut.

The Regulatory Context for the Advanced Clean Cars II Program

The Clean Air Act, initially passed in 1970, and notably amended in 1977 and 1990, set national standards for controlling a variety of atmospheric pollutants, such as nitrogen and sulfur oxides (NO_x and SO_x) emissions from all classes of vehicles. The Act generally pre-empts states from setting their own standards. However, California, was a leader in setting pollution control standards for motor vehicles due to the state's severe air quality problems resulting from the volume and density of its traffic. Because of California's leadership in this area, predating federal efforts, California was granted a preemption waiver in Section 209 of the Clean Air Act. The waiver allows California to set its own motor vehicle standards for controlling pollution, reducing sources of smog, acid rain and other pollutants and setting its own testing procedures and standards under a process administered by the Environmental Protection Agency. Section 177 of the Act allows other states to adopt the California standards instead of less stringent federal standards.[32]

The initial California standards for low emissions vehicles (LEVs) of 1990 included a section on Zero-Emission Vehicle (ZEV) standards. Regulatory authority for improving vehicles emissions was assigned to the California Air Resources Board (CARB). Over time, California's regulatory regime has increased its focus on ZEVs resulting in the Advanced Clean Car regulations, a comprehensive set of requirements and procedures for transitioning to zero-emissions "clean

[32] US EPA, *Clean Air Act Requirements and History*, https://www.epa.gov/clean-air-act-overview/clean-air-act-requirements-and-history.

cars," including cars, light-duty and medium trucks, and heavy trucks setting required emission reduction achievements and timelines for each class of vehicle.[33]

At present, at least 16 States have adopted or are adopting ZEV policies based on California's standards: Colorado, Connecticut, Maine, Maryland, Massachusetts, Minnesota, New Jersey, New Mexico, New York, Nevada, Oregon, Rhode Island, Virginia, Vermont, Washington, and California.[34]

Development of Federal Incentives for EVs

The first federal incentives to encourage consumers to purchase low emissions vehicles were issued under the 2005 Energy Policy Act revisions, as described in an IRS bulletin.[35] Credits up to $3,400 were issued for hybrid vehicles, up to a limit of 60,000 vehicles per manufacturer.

Credits for Qualified Plug-in Electric drive vehicles (EVs and PHEVs) were authorized in the American Rescue and Recovery Act (ARRA) in 2009, providing incentives for PHEVs starting at $2,500 for minimum 5 kWh capacity batteries up to $7,500. Credits were wound down as each manufacturer's qualifying vehicle sales exceeded 200,000. The federal Inflation Reduction Act passed in 2022 will remove the 200,000-vehicle cap as of January 1, 2023.

State Incentives for EVs

The National Conference of State Legislators reports that as of April 2022, 45 states offer some form of incentive for EVs, from simply informing the public of federal tax credits to a variety of state incentives. The incentives range from tax credits or rebates to fleet acquisition goals, exemptions from emissions testing or utility time-of-use rate reductions. For example, New York provides state purchase incentives and offers discounts on toll roads, and the use of HOV lanes. Connecticut, California, and Vermont provide incentives for purchasing used ZEVs and assistance for low-income consumers.

The table and section below briefly describe several key characteristics of the EV transition in four leading states, Connecticut, California, New York, and Massachusetts. The incentive schemes can be complex and vary by vehicle type or usage. Each state has adopted the California waiver of EPA's Section 177 regulations and there are substantial similarities among them. States are further advancing the transition to EVs with new features in accordance with their priorities, policies and legislation. Market share percentages are subject to change as reporting organizations get updated sales reports.

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[33] California Air Resources Board, Advanced Clean Cars II Rulemaking (2022), https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-ii.

[34] California Air Resources Board, *States that have Adopted California's Vehicle Standards under Section 177 of the Federal Clean Air Act* (May 13, 2022), https://ww2.arb.ca.gov/sites/default/files/2022-05/%C2%A7177_states_05132022_NADA_sales_r2_ac.pdf.

[35] IRS Fact Sheet, *Highlights of the Energy Policy Act of 2005 for Individuals*, https://www.irs.gov/pub/irs-news/fs-06-14.pdf.

Table 4. Comparison of EV Program Characteristics in Four Leading States

	Connecticut	California	New York	Massachusetts
EV Registrations	BEV: 15,268	BEV: 794,370	BEV: 56,850	BEV: 15,481
	PHEV: 10,126	PHEV: 406,451	PHEV: 46,169	PHEV: 9,278
	FCEV: 8.8[36]	FCEV: 13,695		ZEM: 30
EV Percent of New Car Sales (January to June 2022)[37]	6.83%	18.32%	5.16%	7.43%
State Incentives (Rebates)	BEV: $2,250	BEV: $2,000 - $4,500	Rebates: Varying incentives for EVs by mileage range, from $500-$2,000. Only $500 Incentive MSRP > $42,000	BEV: $2,500/3,500*
	PHEV: $750	PHEV: $1,500 - $2,000		PHEV: $1,500
	FCEV: $7,500	FCEV: $4,500		FCEV: $3,500
	MSRP Cap: $50,000	MSRP Cap: $50,000		MSRP Cap: $50,000/ $55,000*
Additional "Income Qualified" Rebates	BEV: $2,000	BEV: $4,500	None	$1,500*
	PHEV: $1,500	PHEV: $3,500		
	FCEV: $2,000	FCEV: $7,000		
State Funded Used Car Incentives	Up to $3,000 for income qualified residents who purchase or lease eligible used EVs from a licensed dealership.	Up to $9,500 in rebates or $7,500 in transit mobility options.	None	$3,500*

Note: EV program rebate levels as of October 1, 2022. Rebate levels can change as programs evolve.

* Program incentives marked with an asterisk indicate changes effective November 10, 2022.

[36] Auto Innovate 2022 Q2 Report, https://www.autosinnovate.org/posts/papers-reports/Get%20Connected%20Electric%20Vehicle%20Quarterly%20Report%202022%20Q2%209-13-22.pdf.

[37] *Id.*

Charging Incentives

Developing the charging infrastructure to power EVs is as important as providing purchase incentives. The developing charging infrastructure network includes three levels of electric vehicle supply equipment (EVSE), or EV chargers.

Level 1. Expectations are that many homeowners will charge their cars from their homes. Cars can be charged at household voltage, which takes multiple hours, and portable plug-in chargers are commonly provided with vehicle purchase. Installed level chargers cost estimates vary greatly ranging from $300-$800 for the charger plus installation, bringing total installed cost to about $1,000 or more.

Level 2. Higher voltage chargers shorten charging time dramatically, depending on the car and the charger amperage but also have higher purchase and installation costs, generally requiring a certified electrician as well as other labor. Level 2 chargers are installed in a variety of public and private spaces such as workplace garages, allowing employees to charge their vehicles while at work. Level 2 residential chargers and installation costs vary greatly with one source citing the range as $750 - $2,600, depending upon the installation needs.[38] Commercial Level chargers which can accommodate more than one port at a time cost more because of differences in the chargers, physical site requirements, local codes and other factors.

Level 3. Direct Current chargers operate at much higher voltage and can be configured to serve multiple vehicles but cost substantially more than Level 2 chargers. These chargers may find their greatest use as journey or destination chargers located at highway rest stops, outside stores, or at other strategic locations. Level 3 chargers use DC current and can charge at very high voltage very quickly, but typically require 3-phase electricity and a variety of control equipment. The California Energy Commission tracked 225 DC Fast Charger installations of 1-4 chargers, finding for 1 installed DC fast charger, the average rebate per charger was $62,516, the average unit cost per charger was $45,293, and the average total project cost per DC fast charger was $114,674.[39] Project cost for 4-unit chargers was about $10,000 less.

Connecticut has established a nine-year incentive program for EV charging infrastructure through the electric distribution companies.[40] This program covers up to 50% of the cost of the charger, up to $500 for residential electrical upgrades and up to 100% of commercial make-ready costs depending on the type of charger.[41]

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[38] Electric Car Charging Station Installation Cost, Homeguide.com, https://homeguide.com/costs/electric-car-charging-stations-cost#:~:text=A%20240-volt%20Level%202%20charging%20station%20costs%20%24350,include%20app%20monitoring%2C%20thermal%20regulation%2C%20and%20programmable%20scheduling.

[39] CALeVIP DC Fast Chargers, Average Rebate, Unit Cost, and Total Project Cost per Charger, https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/california-electric-vehicle/calevip-dc.

[40] Connecticut Public Utilities Regulatory Authority, Docket No, 17-12-03RE04, PURA Investigation into Distribution System Planning of the Electric Distribution Companies – Zero Emission Vehicles, Decision (July 14, 2021), https://portal.ct.gov/-/media/PURA/electric/PURA-Establishes-Statewide-Electric-Vehicle-Charging-Program.pdf

[41] *Id.* at 17.

Level 2 and 3 battery chargers not only require the cost of the charger and its installation but require maintenance as well. It is not clear what arrangements for operations and maintenance (O&M) are made in any of the four states. However, grants provided through the National Electric Vehicle Infrastructure (NEVI) program require the state recipients to implement a robust O&M plan.[42] Connecticut was among the first round of NEVI grantees.[43] Table 5 below describes charger goals, incentives and other characteristics.

[42] U.S. Department of Energy, Alternative Fuels Data Center: National Electric Vehicle Infrastructure (NEVI) Formula Program, https://afdc.energy.gov/laws/12744#:~:text=The%20U.S.%20Department%20of%20Transportation%27s,collection%2C%20access%2C%20and%20reliability.

[43] U.S Department of Transportation Federal Highway Administration, Approval of Connecticut Electric Vehicle Infrastructure Deployment Plan (September 14, 2022), https://www.fhwa.dot.gov/environment/nevi/ev_deployment_plans/ct_approval_letter.pdf.

Table 5. Charging Goals and Incentives

State	Connecticut	California	New York	Massachusetts
Goals	60,000 charging ports by 2030. 50,000 residential installations; almost 5,000 "destination" chargers; >7,000 in workplaces and serving light-duty fleets; 550 direct current DCFCs.	250,000 chargers by 2025, including 10,000 fast chargers. 1.2 million by 2030 including 50,000 fast chargers. To date, 80,000 chargers installed, mostly level 2.	50,000 level 2 chargers and 1,500 DC fast chargers by 2025. Emphasis on destinations.	At least 800 fast charging stations located along major state highway corridors, usually within five minutes of the roadway exit.
Residential Incentives	$500 rebate on qualified Level 2 residential chargers + $500 for wiring + enrollment in demand management program.	California State Elec. Infrastructure - Regional rebates vary $6,000-8,500 for Level 2. $80,000 for Level 3. Plus, variety of incentives by electric utilities and Air resources Boards, with large variations around the state.	Income tax credit of up to $5,000 for charging stations. Up to $4,000 incentive for multifamily buildings, shopping centers. Con Ed and PSEG offer additional rebates.	Grants for 60 percent of the cost of Level 1 or Level 2 EV chargers installed at multi-unit dwellings, up to $50,000 per address. Additional utility rebates.
Commercial Incentives	Up to 50% of EVSE cost plus up to 100% of make-ready installation. Project specific caps (up to $250,000 per site for DCFC in underserved communities). Also includes multifamily buildings.	Same menu as residential	Public, Workplace - 60 percent of the funding to a maximum of $50,000 per street address for hardware and installation costs. NYSERDA currently out of funds.	Commercial up to $20,000, doubled in under-served communities.

Note: **California Regional Air Resources Boards** and municipal and investor-owned utilities set their own programs with widely varying incentives, similar to EV purchase incentives.

Inflation Reduction Act

On August 16, 2022, President Joseph Biden signed the Inflation Reduction Act (IRA) into law. The Act addresses a range of economic and other issues, focusing on health care and taxes, and provides approximately $369 billion for carbon-reduction measures, including a range of incentives and requirements intended to support the transition from fossil fuel use to renewable energy, and from ICE vehicles to ZEVs, principally electric vehicles.

The IRA broadens incentives for purchases of electric vehicles, primarily through additional tax credits that can be transferred to auto dealers, beginning in 2024, as well as expanding eligibility for tax credits to used vehicles. It removes the 200,000-unit sales cap that disqualified Tesla and

GM vehicles under the previous law. It sets MSRP caps by vehicle type and includes income eligibility caps.

Table 6. IRA Tax Incentives by Vehicle Type

Vehicle Type	Maximum MSRP for New, Sale Price for Used	Incentive	Other
New Car	$55,000	$7,500**	Must meet assembly and domestic content requirement/material requirements
SUV/Pickup Truck	$80,000*		
Used Cars	$25,000	$4,000 or 30% of price, whichever is less	May not need to meet content requirements. Weigh <14,000 lbs.

Notes: * Definition of what vehicles are SUVs may need clarification, primarily "crossover" vehicles. ** The maximum rebate amount available if all requirements are met.

Assembly and Content Requirement. Cars must be assembled in North America. Batteries must be U.S. manufactured and the percentage of the value of applicable critical minerals, primarily lithium, recycled in North America or extracted or processed in a U.S. free-trade agreement country, must be at least 40 percent in 2023, increasing to 80 percent in 2027. Automaker plans indicate that many are moving to develop domestic battery manufacturing, yet the aforementioned material requirement still applies. There are 23 countries with identified lithium reserves. The six major countries are, in order of size of reserves: Chile, Australia, Argentina, China, Bolivia, and the U.S. In 2020, over 80 percent of lithium production flowed from 13 mines: 6 in Australia, 2 in Argentina, 2 in Chile, and 3 in China.[44]

Automakers and others have expressed concern about the timing of incentives, MSRP caps, and assembly/ materials content requirements.

Timing. The only change to the existing EV credit that takes effect after August 16, 2022, and before the end of 2022, is the introduction of the North America final assembly requirement. Otherwise, the rules in effect before enactment of the Inflation Reduction Act for the EV credit remain in effect, including the phase-out for manufacturers that have sold over 200,000 vehicles in the United States.[45]

MSRP. The MSRP cap will make several higher priced autos ineligible for incentives going forward. KBB.com (Kelley Bluebook) reports the average EV cost at $67,000, although there are a significant number of EVs on the market that fall below the $55,000 MSRP cap for light duty vehicles.[46] This may move some manufacturers to scale back some features and accessories to

[44] Journal of International Economic Law, Volume 25, Issue 1 (March 2022) Pages 148-170, https://doi.org/10.1093/jiel/jgac002.
[45] Frequently Asked Questions on the Inflation Reduction Act's Initial Changes to the Electric Vehicle Tax Credit (treasury.gov)
[46] *See, e.g.,* Connecticut CHEAPR, "New Eligible Vehicle List" at https://portal.ct.gov/-/media/DEEP/air/mobile/CHEAPR/CHEAPR-New-Eligible-Vehicle-List-Modified-9-8-2022.pdf (identifying eligible vehicles pursuant to Connecticut's lower $50,000 MSRP cap).

meet the cap. There could also be some vehicle classification issues. A number of current "crossover" vehicles may be put forward as EUVs (Electric SUVs) even though they don't meet the weight range specified for SUVs.

Where was it Made? Because many automakers are truly international, individual vehicles made by some companies may be assembled in North America, but others may be assembled elsewhere and therefore would not be eligible. Consumer Reports recommends that buyers obtain the Vehicle Identification Number (VIN) of a car to be purchased to learn where the car was assembled, information encoded within the VIN.

Income Limitation and Calculation The IRA establishes that individuals whose income is above $150,000 or couples with a $300,000 annual income are not eligible for the incentives. In determining income eligibility the standard will be Modified Adjusted Gross Income which includes several types of income that are typically excluded from Adjusted Gross Income, such as individual retirement account contributions, student loan interest paid and other items exempted from Adjusted Gross Income on tax returns. How this income eligibility issue will be handled in the purchase and rebate process, once tax credits for purchasing EV's go directly to dealers in 2024, is unknown at this time.

Potential Effects on Connecticut EV adoption

Plans of the major automakers should greatly expand the choice and availability of EV models for Connecticut's consumers, especially as provisions of the IRA become effective. However, because of some of the IRA content provisions, full implementation seems likely to be slowed, making Connecticut's state-level incentives much more important in the current and near-future EV transition. Automakers have expressed concerns that the new federal rules coming into effect in 2023 will serve to slow the EV transition, despite automakers' investment efforts to ramp up domestic production of both vehicles and batteries.

To date, the bulk of EVs have been high-end vehicles by Tesla, with more high-end vehicles emerging from most of the major manufacturers. Tesla has not qualified for a federal tax incentive for several years, yet it still leads the BEV market. To continue to promote sales under the IRA, some high-end manufacturers may provide their own incentives to serve their target customers. Lacking access to federal incentives may not be a barrier to the sale or lease of these EVs.

The lower end of the EV market, represented by vehicles such as the GM Bolt, Nissan Leaf, Hyundai Ionic and several Kia models, may do relatively well in states like Connecticut. Generous incentives for lower end EVs for low- and moderate-income buyers, and increased emphasis on used BEVs and PHEVs can take up some of the slack, assuming the battery materials issue can be successfully addressed. It is much too soon to tell how things will play out but moving forward with state incentives in the short term may be the best path.

Development of Alternative Fuels

Economic Factors in Vehicle Fuel Choice by Vehicle Type, Usage for LDVs, MDVs, and HDVs

The earliest powered vehicles in the late 19th century were battery powered. Electric vehicles had advantages over ICE vehicles, including lack of combustion emissions, but did not prevail in the marketplace. There are various explanations for the eventual dominance of ICE vehicles, including the higher purchase cost of electric cars (though lower operating costs), relative limitations on battery range and speed, marketing, and the relative lack of development of charging infrastructure compared with existing gasoline infrastructure.[47]

The need to decarbonize the environment is leading to the reduction and possible eventual elimination of ICE vehicles, but the question from an economic perspective then becomes what are the most appropriate technologies for varying vehicle types and their varying uses? Lithium powered batteries are currently the dominant technology but according to The New Scientist, multiple other battery types are being investigated, including sodium, magnesium, iron-air and liquid (flow)[48] Scaling up production of BEVs can result in lower total costs depending upon the type of vehicles considered, their usage, and other factors such as vehicle miles traveled (VMT). Another commercially available alternative is fuel cells, powered by hydrogen gas. Each of these technologies have strengths and weaknesses from an economic perspective. The question therefore is what are the best uses for them?

To answer this question, studies such as the one recently published by the federal National Renewable Energy Laboratory (NREL)[49] examined the economics from several perspectives. BEVs are currently most economically optimal for light-duty vehicles including passenger cars, pick-up and local delivery trucks. They are also optimal for medium vehicles and heavy-duty vehicles depending upon their usage and when their regular travel is short-to-medium range. Of the various alternatives, the fuel cell approach, using extracted hydrogen in FCEVs is the most developed and is being actively explored as an economic alternative. However, the most environmentally sustainable form of extracted hydrogen, "green hydrogen", has a higher cost compared to other fuels. Hydrogen can be extracted from natural gas (blue hydrogen) and is the cheapest available source to power fuel cells, but there are significant emissions from its extraction and use, limiting the carbon reduction benefit from its use in fuel cells.

According to NREL and other analyses, FCEV heavy-duty vehicles used for long haul transport are expected to be the better economic choice in this case because of their advantages over batteries in refueling time, weight, capacity, and cost. On the road experience will test these assumptions. NREL notes the substantial caveat that the cost of green hydrogen as a fuel will have a large impact on FCEV total ownership and operations costs. It is possible that as the cost of green

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[47] Andrew Heinzman, *New Research Shows Why Electric Cars Failed in the Early 1900s*, Review Geek (October 17, 2021), https://www.reviewgeek.com/100742/new-research-shows-why-electric-cars-failed-in-the-early-1900s/.

[48] *Are there any lithium battery alternatives?*, *New Scientist*, https://www.newscientist.com/question/lithium-battery-alternatives/.

[49] National Renewable Energy Lab, *Decarbonizing Medium and Heavy-Duty On-Road Vehicles: Zero-Emission Cost Analysis* (March 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

hydrogen comes down over time, and availability increases, FCEVs will look like the better choice in some other vehicle types and usages.

SP Global reports, "green hydrogen produced with renewable resources costs between about *$3/kg and $6.55/kg*, (emphasis added) according to the European Commission's July 2020 hydrogen strategy. Fossil-based hydrogen costs about $1.80/kg, and the commission estimated the cost of hydrogen production that pairs carbon capture with steam methane reformation of natural gas, at about $2.40/kg."[50]

There are several reasons why the costs of green hydrogen are expected to fall. A number of new technologies are in development in the U.S. and around the world. Incentives in the IRA for improvements in hydrogen production techniques and the building of hydrogen generation include 10-year subsidies ranging from $0.60/kg generated to $3/kg for the lowest emission processes, and $8 billion for the establishment of regional hydrogen hubs to further hydrogen development. Beyond the subsidies, hydrogen production will benefit from scaling up to commercial/industrial uses, refinements in materials and processes and other economies of scale. The largest portion of this work is expected to focus on industrial processes where hydrogen can substitute for high temperature fossil fuels that produce a substantial quantity of greenhouse gases.

EV Forecast and Economic Analysis

A transition to EVs in Connecticut will have significant implications for the statewide economy. This section explores the impacts of electrification by comparing EV growth under the policy to a business-as-usual (BAU) scenario where EVs still expand in Connecticut, but not as quickly. A variety of economic impacts result from the EV scenario. They fall into the following categories:

- Energy dollars kept in-state – gasoline and diesel fuel expenditures (now flowing to out-of-state producers) are avoided.
- Business growth and development – potential growth of Connecticut-based suppliers and distributors of electric vehicle parts, batteries, maintenance services, charging stations, and energy generation and related new technology development, all of which can offset losses of gasoline and diesel vehicles, fuels, and maintenance activities.
- Long-term cost savings to residents and businesses due to lower fuel/energy and maintenance costs of EVs, leading to more disposable income for residents and greater productivity for businesses, in turn generating more net disposable consumer income within Connecticut.
- Broader job and income growth within Connecticut – occurring as a direct consequence of the preceding three classes of impact, which will lead to further indirect effects on the

[50] Tom DiChristopher, *Experts explain why green hydrogen costs have fallen and will keep falling*, S&P Global Market Intelligence (March 5, 2021), https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/experts-explain-why-green-hydrogen-costs-have-fallen-and-will-keep-falling-63037203#:~:text=Fossil%2Dbased%20hydrogen%20costs%20about,%2C%20at%20about%20%242.40%2Fkg.

growth of Connecticut-based suppliers serving the benefitting industries, and induced effects on workers re-spending their added income on consumer purchases within Connecticut.

Electric Vehicle Forecast

To estimate various benefits of Connecticut's proposed EV policy, it was necessary to first develop a forecast of EV sales and adoption. Table 7 summarizes the forecast for select years between 2022 and 2050, including estimates of the share of annual vehicle sales that are EVs, total annual EV sales, cumulative EVs in operation, as well as the additional EVs in operation and their associated vehicle miles traveled (VMT) relative to the BAU scenario. The last two categories form the basis for benefits calculations since we are interested in the net effect of the policy. The BAU scenario assumes that EVs will still experience growth in Connecticut, but not as rapidly as under the policy scenario.

It was necessary to include 2022-2025 before the policy takes effect because of a needed ramp-up in EV sales in order to meet the 100 percent target in 2035. Under the proposed policy, EVs will comprise 100 percent of all sales by 2035. This is an increase from 8.8 percent today and an estimated 68 percent in 2030. Note: The sales forecast does not account for compliance flexibilities granted to vehicle manufacturers, given their current uncertainty. Table 7 shows how this increase translates into annual EV sales and EVs in operation, as well as additional EVs in operation and additional EV VMT compared with the BAU scenario. These differences are what drive the economic impacts.

Table 7. Connecticut Electric Vehicle Forecast

Year	EV Share of Total Sales (Annual)	EV Sales (Annual)	EVs Operating (Cumulative)	Additional EVs Operating Relative to BAU (Cumulative)	Displaced ICE VMT Relative to BAU (Annual)
2022	8.8%	15,600	38,000	12,600	169,716,700
2030	68%	133,900	710,200	496,200	6,687,076,800
2035	100%	210,600	1,227,000	824,400	11,109,304,400
2050	100%	245,600	2,985,200	2,019,400	27,213,726,900

Sources: Connecticut Department of Motor Vehicles, Connecticut Department of Transportation, EVAdoption, Moody's Analytics, U.S. Department of Energy, U.S. Department of Transportation.

The following explains how we derived each EV forecast variable and its underlying assumptions:

- **EV vehicle sales:** Sales forecast provided by EVAdoption, a leading EV consultancy that provides market research for clients around the U.S. EVAdoption's forecast is based on research from a variety of public and private sources. We validated its reasonableness by comparing the EVAdoption forecast to forecasts of EV sales in other states. EVAdoption's forecast ends in 2030. To extrapolate it to 2035, when the policy requires that 100 percent of sales are EVs, we used a linear trendline.
- **EV vehicles in operation:** Provided by EVAdoption through 2030. We used exponential smoothing to extrapolate the forecast to 2050.
- **Vehicle miles traveled:** Calculated by multiplying vehicles in operation by the average VMT per passenger vehicle in Connecticut according to the U.S. Department of Transportation.

Economic Impact Framework

This section describes how we modeled the economic impacts of an EV-driven technology shift. Our analysis uses the framework of IMPLAN, the nation's leading model system for statewide economic impact studies.[51] IMPLAN builds on the national input-output (I-O) accounting tables regarding how each sector of the economy buys from and sells to others, adapted to reflect Connecticut's specific economy and how its business activity also depends on activities outside of the state.

The I-O tables incorporate a "technology matrix" that shows what kinds of resources, parts, and materials are used to generate the goods and services provided by each industry. This approach, building on past surveys of business, is reasonable for evaluating the broader economic consequences of opening, closing, growing, or shrinking a specific type of activity (e.g., gaining or losing a factory or army base). However, it is not reasonable when the economic impact evaluation is for a policy or program that itself will shift the technology matrix by changing the mix of parts and materials being used. That is the case for the shift in car technology from internal combustion to electric vehicles. Accordingly, our analysis focuses on how the technology change will affect the Connecticut economy.

When shifting car technologies, the key impact factors for Connecticut become: (1) the extent to which jobs will be *lost* in industries associated with the older, legacy technology, (2) the extent to which jobs will be *gained* in industries associated with the new, emerging technology; and (3) the extent to which household and/or business costs will change, leading to further productivity and/or spending impacts.

To evaluate impacts associated with factors #1 and 2, we had to consider, (1) the extent to which there will be change in the mix of various manufactured parts and supporting service elements (sales, fuel, and maintenance); (2) the extent to which each of these elements now exists in

[51] Learn more about IMPLAN at https://implan.com/.

Connecticut or is expected to grow in Connecticut as demand increases over time. Our analysis and findings include the following:

1) Some major elements will be relatively unchanged by the technology shift, like the parts supply chain, assembly process, repair and maintenance processes for car frames, bodies, tires, suspensions, steering, lights and air conditioning systems. Both electric and gasoline cars have these same basic systems and parts, so demand for them will be relatively unchanged by the technology shift.
2) Some elements will decline as electric vehicle technology no longer requires fuel pump systems, oil pump systems, and spark/ignition systems. Our analysis of the Connecticut economy shows that the state currently has relatively little in the way of parts manufacturers for these kinds of systems for cars, so there will not be much impact to Connecticut's economy.
3) Some elements will grow, as electric vehicle technology creates demand for advanced technology products including rechargeable (Lithium Ion) batteries, charging stations and equipment, electric motors, and power controls -- not previously required in ICE vehicles. If we also consider the potential for hydrogen fuel cells as an alternative to the battery electric technology for heavy-duty long-haul trucks, then that is another element not in current vehicle products. Our analysis shows that Connecticut already has a growing position in the development and production for each of these advanced technologies, which we discuss further below.
4) Some elements will be transformed. For instance, the switch from gas stations to electric charging stations changes the nature of construction and operation, and the types of jobs they create. Most gas stations have already moved to rely largely on automated self-pump operations with credit card payment. Our analysis notes that the shift to EV charging will push that trend further. It will also shift occupations and required worker skills for installing and maintaining charging station networks.
5) Other elements will be transformed but with muted impact. EVs have fewer physical parts so their reliability is expected to increase with lower repair costs, but that is just extending an existing long-term trend towards greater vehicle reliability. To the extent that there will be a reduction in car maintenance costs, this savings will generate spending in new ways that will also generate other types of jobs.

Economic Impacts

Effects on the economy will occur as a result of shifts in the flow of purchasing and spending from gasoline to electric vehicles, and broader indirect and induced consequences for jobs, income, and tax revenue. Our analysis was based on comparison of two scenarios — a scenario of "business as usual" and a scenario of "shift to EVs." The latter scenario reflects direct effects of shifts in spending for vehicles, fuel/energy and their operation, which reflect changes that can be expected with an accelerated EV transition. Our analysis utilizes the IMPLAN input-output model for Connecticut, which traces flows of dollars to, from, and between buyer and supplier industries in Connecticut. The economic model itself was updated for evaluation of the EV shift scenario, to

account for recent and anticipated future shifts in fuel sources for motor vehicles and electricity generation sources.

Table 8 shows the economic benefits and disbenefits of the proposed policy. We estimated the direct impact of benefits and disbenefits using ratios from various reports and data sources described below. We then estimated the total impact — including effects on suppliers and household spending — using the IMPLAN economic model. In the case of vehicle parts manufacturing, we customized IMPLAN to better reflect the change in technology associated with EVs. The following sections describe each class of positive and negative economic impacts, along with the methodology and assumptions underlying our analysis. The economic analysis represents a total impact over 29 years (2022-2050) and corresponds directly with the gradual phase-in of EVs discussed earlier.

Vehicle & Vehicle Parts Manufacturing Technology

We assume there will be no change among scenarios in total automobile sales, but there will be differences among the scenarios for various car components. Specifically, the rise of EVs will bring a reduction in demand for internal combustion engines, fuel tanks, fuel and oil pump systems, and spark ignition systems, though relatively little of these components are now made in Connecticut. On the other hand, there will be an increase in demand for electric motors, batteries, charging systems, and electronic controls. There is also a price premium of EVs compared with ICE vehicles of about $1,700 per vehicle, on average. We assume the price premium will primarily benefit battery manufacturers and sellers in Connecticut rather than auto dealers or manufacturers of parts used in both EVs and ICE vehicles. We account for this impact in the model, assuming the price of EVs will eventually fall to reach parity with ICE vehicles sometime between 2025-2030.[52]

We accounted for these changes through custom adjustments to the IMPLAN economic model to reflect the change in vehicle technology from internal combustion to electric. This involved two types of changes: (a) changing the parts and equipment, i.e., commodities, that go into vehicle production, and (b) changing the share of commodities that are provided within Connecticut. Changes were based on the state of the automotive industry in Connecticut as well as on interviews we conducted with industry experts. Both changes have the effect of increasing the impact electrification will have on Connecticut, particularly because the state is well-positioned to support the EV industry as we discuss in the next section.

More specifically, the economic growth potential for Connecticut comes from the fact that the state has a growing base of advanced technology firms related to the production of rechargeable lithium-ion batteries, charging systems, and power control systems – which stand to benefit from the growth of demand for electric vehicles. Connecticut also has a significant and growing base of firms developing and applying hydrogen fuel cell technology. The breadth of these industries in Connecticut is demonstrated in the text box on Page 32. For this reason, the Connecticut

[52] "Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy—2025-2035," Consensus Study Report, National Academy of Sciences, March 2021, http://nap.edu/26092.

economy stands to gain jobs in growing technology industries that will more than offset the loss of jobs associated with reduction in need for ICE vehicles.

Vehicle Operation & Maintenance Savings

Since EVs have significantly fewer parts, Connecticut EV owners are expected to save on maintenance and operations costs between 2022-2050.[53] This includes reduced spending on fuel, parts, and repairs compared with ICE vehicles and diesel vehicles. This does not account for costs of insurance, which we assume are similar for EVs and ICE vehicles. These direct savings translate into additional household spending on other goods and services. Estimated EV savings are $0.04/mile compared with ICE vehicles, which is a conservative estimate since EVs are constantly being improved. When applied to the additional EV VMT between 2022-2050, this represents $14.5 billion less spending on vehicle repair (not including fuel). Diesel vehicles are accounted for with ICE vehicles in the economic analysis.

Transition from Gasoline and Diesel to Electric Power

A transition to EVs will reduce demand for gasoline and diesel fuels in the amount of $41.5 billion from 2022-2050, based on 35.1 mpg equivalent for EVs at $4 per gallon. Since Connecticut imports the petroleum it uses,[54] the impact of this spending decrease will be limited to reduced retail markups and state fuel tax revenue (about $8.1 billion).[55] On the other hand, the transition will significantly increase demand for electricity in Connecticut. We estimate that additional EV VMT between 2022-2050 will require $24.8 billion in new electricity expenditures.[56] However, increased electricity spending by Connecticut households will be offset by the reduced gasoline spending, resulting in net savings of approximately $16.7 billion from 2022-2050.

Transition from Gas Station to Charging Station Development

The proposed policy will reduce demand for gasoline and fueling stations while increasing demand for electricity and charging infrastructure. The EV transition will require the development of approximately 1.1 million residential EV chargers and 379,300 public and workplace EV charging ports by 2050.[57] The development of these residential chargers could cost an estimated $2.2 billion between 2022-2050. The development of non-residential chargers could cost $14.3

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[53] Assumes operating and maintenance costs of $0.167/mile for ICE vehicles and $0.04/mile for passenger BEVs, resulting in a savings of $0.13/mile applied to 438.6 million VMT from 2022-2050. Sources for ICE vehicle and BEV operating, and maintenance costs are TREDIS and the California Air Resources Board (CARB) Standardized Regulatory Impact Assessment (SRIA) for the Advanced Clean Cars II (ACC II) regulations, respectively.

[54] Connecticut State Profile and Energy Estimates, U.S. Energy Information Administration (October 20, 2022), https://www.eia.gov/state/?sid=CT.

[55] The Connecticut fuel tax is 25 cents per gallon, https://www.salestaxhandbook.com/connecticut/gasoline-fuel

[56] Assumes an electricity cost of $0.07/mile. This is based on the assumption that the average BEV requires 0.27 kWh/mile, and electricity is priced at a weighted residential-commercial rate of $0.2531/kWh. Weighting assumes 80 percent of charging happens at home and 20 percent happens at public charging stations. Sources include the ACC II SRIA for fuel efficiency, the U.S. EIA Connecticut State Energy Profile for electricity pricing (August 2022 period), and NREL and USDOE for the residential charging share (https://www.nrel.gov/docs/fy21osti/78540.pdf). The analysis also assumes that electricity rates will not increase in future years, on average.

[57] Calculated using the ratio of charging ports to EVs in operation found in Edison Electric Institute (EEI), Electric Vehicle Sales and the Charging Infrastructure Required Through 2030, June 2022. EEI estimates were developed using USDOE's EVI-Pro Lite tool and a charging infrastructure assessment from the California Energy Commission.

billion, which represents increased spending on construction, installation, and equipment that will benefit Connecticut businesses.[58] These EV charger costs are incurred in lieu of spending that would otherwise be incurred for future gas station investments and fuel purchases.

In addition to the direct effects summarized above, the economic analysis considers broader effects on the Connecticut economy. These include "indirect" or "upstream effects," i.e., changes in sales for Connecticut firms that provide parts, materials, and services for the directly affected industries. They also include "induced" or "downstream effects," i.e., changes in sales for Connecticut firms driven by the increase in workers and worker income resulting from the shift to advanced technology EV parts and their suppliers. Table 9 also shows the magnitude of these additional impacts.

Net Economic Impact

Table 8 summarizes the direct changes in spending patterns in Connecticut associated with the EV policy. It reflects a pattern in which EV adoption brings reductions in demand for gasoline and reduced costs of car repair while simultaneously increasing demand for electricity and charging stations. There are also higher initial vehicle costs associated with EVs, at least until 2025-2030 when they are expected to reach price parity with ICE vehicles.[59] These various effects lead to corresponding changes in household spending and revenues to various sectors of the economy. Most of these gains and losses cancel out in terms of total income. However, there is one very notable change: Connecticut has little to lose in terms of income from producing parts for internal combustion engines and supporting systems, yet the state stands to potentially gain many more dollars in research and development of electronic and electrical systems, controls, and power system elements for EVs.

[58] Assumes that each residential charger costs $2,000 and each non-residential DC fast charger costs $37,584. The source for charger costs is the California Energy Commission.

[59] "Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy—2025-2035," Consensus Study Report, National Academy of Sciences, March 2021, http://nap.edu/26092.

Table 8. Direct Effects of Increased EV Adoption on Patterns of Spending in Connecticut, 2022-2050 (29-Year Total in Billions of Constant 2021 Dollars)

Positive And Negative Impact Categories	Directly Impacted Party	Spending Effect ($B)
Additional Income (or Reduced Cost)		
EV Vehicle Parts Development & Manufacturing in CT	EV Parts Manuf.	+$46.9
Vehicle Operating & Maintenance (Cost Savings)	Households	+$14.5
Electricity Generation (Sales)	Utilities	+$24.8
Public Charging Station Development (Spending)	Installers	+$14.3
Residential Charger Installation (Spending)	Installers	+$2.2
Gasoline Savings	Households	+$41.5
Positive Impacts Subtotal		**+$144.2**
Reduced Income (or Added Cost)		
ICE Vehicle Parts Manufacturing in CT	ICE Parts Manuf.	-$0.2
Additional Electricity Spending	Households	-$24.8
Reduced Gasoline Spending	Gas Stations	-$41.5
Reduced Repair Spending	Repair Shops	-$14.5
Vehicle Purchases (Initial EV Price Premium)	Households	-$6.6
Public Charger Installation	Government & Businesses	-$14.3
Household Charger Cost	Households	-$2.2
Negative Impacts Subtotal		**-$104.1**
Net Income Increase		**+$40.1**

* Accounts for the fact that there is a greater share of Connecticut content in electricity and battery development than there is in gasoline and ICE parts manufacturing.

While Table 8 shows direct effects of changing spending patterns for households and businesses, those direct effects ultimately lead to shifts in employment and value added for various industry sectors in Connecticut. Those impacts are shown in Table 9. Value added reflects the portion of total business income that goes to pay Connecticut workers, buy materials made in Connecticut, and generate profits for Connecticut businesses. This also represents the change in gross domestic product (GDP). Since the Table 9 results reflect just the portion of Table 8 spending changes that affects income within Connecticut, the values in Table 9 are lower than the spending numbers in Table 8.

In particular, Connecticut has negligible manufacturing of ICE components such as gas engines, tanks, transmissions, or coolant systems. Losses from spending on those elements therefore has a minor impact on the state's GDP. On the other hand, Connecticut is home to some electricity generation and development of advanced battery and electric controls, so it stands to gain a larger share of income coming from additional spending on those elements.

More income for Connecticut businesses also leads to "indirect" effects in the form of supply chain orders for parts and materials, some of which are in-state. It further leads to "induced" effects on worker income, which generates further consumer spending effects. All these impacts are shown in Table 9.

When indirect and induced impacts are included, the net impact on employment in Connecticut equals 128,180 additional job-years, representing an average of 4,420 more jobs than would otherwise exist each year. The net impact represents an increase of $25.7 billion in GDP.

Table 9. Economic Impact Results: Changes in Total Job-Years and Value Added (GDP) in Connecticut Due to Increased EV Adoption, 2022-2050 (29-Year Total in Billions of Constant 2021 Dollars)

Positive And Negative Impact Categories	Directly Impacted Party	Total Job-Years	Total Value Added (GDP) Impact
Additions To Business Jobs and GDP			
EV Vehicle Parts Manufacturing (Increased EV Demand)	Vehicle Parts Manufacturers	96,400	+$10.7
Electricity Generation (Sales)	Utilities	75,200	+$9.4
Public Charging Station Development (Spending)	Installers & Parts Suppliers	2,100	+$7.0
Residential Charger Installation (Spending)	Installers & Parts Suppliers	320	+$1.1
Vehicle Sales (Initial EV Price Premium)	Battery Manuf. & Sales	1,940	+$0.2
Positive Impacts Subtotal		**175,960**	**+$28.4**
Subtractions To Business Jobs and GDP			
ICE Vehicle Parts Manufacturing (Reduced ICE Vehicle Demand)	Vehicle Parts Manufacturers	-760	-$0.1
Reduced Gasoline Spending	Gas Stations	-44,700	-$5.9
Reduced Repair Spending	Repair Shops	-55,100	-$7.3
Negative Impacts Subtotal		**-100,560**	**-$13.3**
Net Direct Impact		**75,400**	**+$15.1**
Indirect And Induced Economic Activity (Net Change)	**All Industries**	**52,780**	**+$10.6**
Net Total Impact		**128,180**	**+$25.7**

Model Adjustments

As discussed previously, we made custom adjustments to the IMPLAN economic model to reflect the change in vehicle technology from internal combustion to electric. This involved two types of changes: (a) changing the parts and equipment, i.e., commodities, that go into vehicle production and (b) changing the share of commodities that are provided within Connecticut. Changes were based on the state of the automotive industry in Connecticut as well as interviews we conducted with industry experts. Both changes have the effect of increasing the impact electrification will have on Connecticut, particularly because the state is well-positioned to support the EV industry as we discuss in the next section.

Economic Development Opportunities

This section discusses opportunities for growing and further developing the EV industry in Connecticut. Instead of importing most parts and equipment that go into EV manufacturing, charging station manufacturing, and other forms of infrastructure necessary to support electrification, Connecticut can take steps to produce more in-state. This is known as "import substitution" and is a proven way of maximizing the economic impact of policy changes and new investments.

The transition to EVs also presents an opportunity to develop new occupations and career paths for Connecticut workers. Besides the obvious case of battery and charging facility technologies, the transition to EVs may produce opportunities for skilled designers to develop needed control and financial software, such as interoperability of multiple charging platforms. Additional opportunities in EV charging infrastructure design, installation, and maintenance will also likely become available. Special attention can be given to accelerating demand for supporting industries via municipal and corporate fleet conversions.

It is critical to note that electric cars and trucks still account for a small share of today's vehicles, and their advanced technologies are relatively new. With increasing federal and state incentives and high gas prices, demand for EVs is projected to accelerate substantially in future years. This has spurred continued technology advances to make more efficient, productive, and better performing EVs, and is associated with what is now a flurry of new R&D and investment in new production technologies for battery, charging, motor, and control system elements for EVs.

This means that, for Connecticut, there is an economic development opportunity to attract and grow firms that design and produce these advanced technology elements of EV systems. The impact on Connecticut's economy associated with expanding EVs will not be automatic, for the simple reason that these are rapidly evolving industries, and they are not fixed in where they will locate and grow in future years. However, we can identify reasonable and logical scenarios for likely outcomes based on the current position of Connecticut in attracting investment in these industries, as well as the emerging trends and competitive prospects for the state. The following text box highlights some of these prospects.

Examples of ZEV-Related Advanced Technology Industries

Charging Stations

- Connecticut has already attracted some firms that have become national players in EV charging and expects more future growth as battery technology further evolves.
- EVSE LLC in Enfield makes Autocoil, EVSE and Charge Works brands of charging stations, which are top rated for municipal and fleet systems (e.g., featured on Melrose, Massachusetts' municipal system).
- Juice Bar Charger in Southbury sells commercial charging stations and is in over 100 cities. They are made in Connecticut by Gyre 9.

Lithium-Ion Batteries

- Cadenza Innovation is a Connecticut-based lithium-Ion battery manufacturer that has attracted significant investor base to develop ground-breaking battery pack architectures and global Tier 1 partners.
- BST Systems also makes batteries in Connecticut, currently focusing on deep sea and space uses.
- Ener-Tek International (Yardney division), is another major manufacturer of lithium-ion batteries, currently focusing on defense and industry equipment. It recently moved from Connecticut to an expanded facility in Rhode Island, but it still has supply chain activities spanning Connecticut and Rhode Island.
- Connecticut is a leader in R&D for improving the efficiency of Li-on battery technology and is poised for further attraction of new prototypes for battery manufacturing processes.

Power Controls & Management Systems

- Cougar Electronics provides power inverters for industrial uses as well as railroad and bus use.
- OEM Controls makes battery power management systems for railroads and aircraft.
- Electric Boat makes submarines and Sikorsky makes aircraft, though both have electric supply chains that could be applied for ground vehicles.

Hydrogen Fuel Cells

- This technology produces electricity on-board the vehicle without requiring charging stations. It is expected to be most applicable for long distance trucking and is also being tested for long distance trains.
- Doosan Fuel Cell America, in Connecticut, is one of the largest national manufacturers of fuel cells, and NEL is a leading maker of hydrogen fueling station equipment. Current products are for industry rather than transportation use, but these manufacturers are positioned to make this transition.
- Connecticut is the Hydrogen Hub national leader (though California also has a hub). Connecticut is working with Michigan in putting these technologies together for automotive applications. In fact, CCAT wrote Michigan's hydrogen fuel cell development plan. Connecticut's Hydrogen and Fuel Cell Development Plan was produced in 2018 by the Northeast Electrochemical Energy Storage Cluster.
- CCAT also runs the Connecticut Hydrogen-Fuel Cell Coalition (chfcc.org) whose members include DECD, Connecticut Green Bank, UConn C2E2, Connecticut Clean Cities, Connecticut transit, Connecticut Department of Transportation (CDOT), plus manufacturers such as Fuel Cell Energy (power plants), Infinity Fuel Cell (supports NASA), Precision Combustion (power generation, mfg. uses).
- Connecticut Special Act 22-8 created a task force on hydrogen technology for the state's economic development. Recommendations from the Task Force are due by January 1, 2023.

Our work builds on an analysis of trends in the development of Connecticut's economy and additional economic development insights obtained from conversations conducted with staff of the Connecticut Department of Economic and Community Development (DECD), Connecticut Center for Advanced Technology (CCAT), AdvanceCT, and the governor's Chief Manufacturing Officer. We found strong evidence that Connecticut is one of the recognized national leaders in advanced technology development and implementation, spurred by major industries providing submarines, aircraft, and energy systems for government defense.

The advanced technology workforce skills that have developed, and the high value supply chain ecosystem that has evolved, support advanced technology elements for other watercraft, trains, satellites, and cars. This is part of an intentional strategy being pursued by statewide economic development agencies to further develop Connecticut's economic base, building on the growing EV market. The 2022 Inflation Reduction Act, along with the earlier Infrastructure and Investment Jobs Act, will provide additional resources for a rapid buildup of EV infrastructure, enhanced and broadened EV tax credits, and opportunities for research on hydrogen and other alternative fuels. These will be combined with initial subsidies designed to reduce the cost of renewably generated hydrogen, furthering the work that CCAT is currently engaged in.

Economic Value of Societal Benefits

In addition to the significant economic impacts and benefits of Connecticut's 100 percent EV sales policy detailed above, there are a stream of societal benefits that must be identified and quantified to provide a complete picture of the positive individual and societal impacts of the policy. The two primary societal benefits are health and air quality improvements through the reduction of criteria and toxic pollutants, and the reduction in greenhouse gas emissions.

Health and Air Quality Benefits

Breathing unhealthy air poses serious risks to human health and increases the incidence of many respiratory ailments such as asthma attacks and lung cancer, the leading cause of cancer-related deaths in the U.S. The two primary types of air pollution, ozone (O_3) and particle pollution, including nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter (PM2.5), and volatile organic compounds (VOCs), can increase the risk of other serious impacts on human health, including lung tissue swelling and irritation, developmental damage in children, increased susceptibility to infections, cardiovascular disease, and premature death from heart attacks and stroke.[60] Additionally, air pollution disproportionately affects Connecticut residents in overburdened and underserved communities.[61] Substantial pollution emission reductions in Connecticut will be achieved through the implementation of the ACCII policy, which will result in cleaner, healthier air in the state, particularly in environmental justice communities, improved public health, and reduced health care costs. Our analysis finds that Connecticut's adoption and implementation of the ACC II policy will result in significant pollutant emission reductions between 2022-2050, as detailed in Table 11 on page 36. The avoided emission costs for these air pollutants are detailed in Table 13 on page 41.

Carbon Reduction Benefits

It is well documented by the UN's International Panel on Climate Change (IPCC) that in order to maintain a habitable global climate, carbon emissions must be dramatically reduced in every country and in every emissions sector, in line with the world's remaining carbon budget – the amount of carbon that can still be emitted without exceeding 1.5° C (3.6°F) temperature rise and risking crossing irreversible climate tipping points (i.e., runaway global heating).[62] Table 10 shows that, as of 2020, to have a 67 percent chance of staying under 1.5°C temperature rise, the world's remaining carbon budget is estimated at 400 gigatons of carbon-dioxide equivalent ($GtCO_2e$).

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[60] *The Terrible 10: Air Pollution's Top 10 Health Risks*, American Lung Association (April 6. 2017), https://www.lung.org/blog/air-pollutions-top-10-health-risks

[61] *The Air Quality Health Benefits of Climate Action in Connecticut*, Yale Center on Climate Change and Health (May 2021), https://ysph.yale.edu/yale-center-on-climate-change-and-health/policy-and-public-health-practice/yccch%20air%20quality%20issue%20brief_412616_48542_v1.pdf

[62] *Mitigation Pathways Compatible with 1.5°C*, SR15, Chapter 2, IPCC (2022), https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Chapter_2_LR.pdf

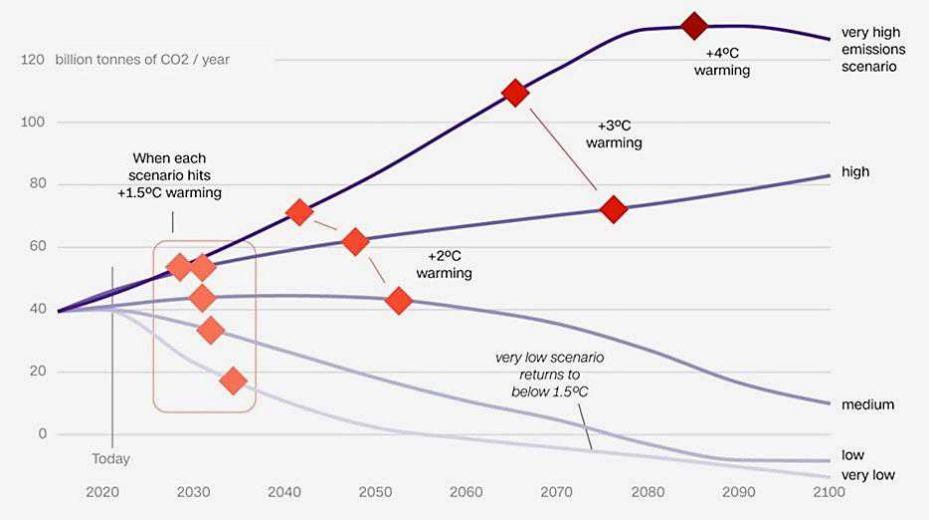
Table 10. Estimated Remaining Global Carbon Budget for Not Exceeding Temperature Rise Thresholds

Approximate global warming relative to 1850–1900 until temperature limit (°C)*(1)	Additional global warming relative to 2010–2019 until temperature limit (°C)	Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$) *Likelihood of limiting global warming to temperature limit*(2)*				
		17%	*33%*	*50%*	*67%*	*83%*
1.5	0.43	900	650	500	400	300
1.7	0.63	1450	1050	850	700	550
2.0	0.93	2300	1700	1350	1150	900

Source: Intergovernmental Panel on Climate Change (2018, October). IPCC special report on global warming of 1.5°C; Ch. 2, p.108.

The most recent report from the IPCC, AR6 Working Group I, concludes that the world is on track to warm by at least 1.5°C in the five scenarios modeled.[63] Figure 2 shows that, even in the lowest emission scenario, the 1.5°C threshold is crossed around 2035. The non-linear nature of abrupt changes in the global climate system, and the prospect of crossing such tipping points, are the principal reason for concern about climate change, and the driving motivation to reduce carbon emissions.[64]

Figure 2. Global Temperature Rise With Five Carbon Emissions Reduction Scenarios



Source: IPCC AR6 Working Group I report; Graphic: John Keefe, CNN/New York Times.

So, the scientific urgency of transitioning Connecticut's light-duty transportation fleet to ZEVs is clear. Connecticut's 2018 Greenhouse Gas Emissions Inventory reveals that the state is not on

[63] 6th Assessment Report, AR6, Technical Summary, IPCC (2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf

[64] *The human imperative of stabilizing global climate change at 1.5°C*, *Science* (September 20, 2019), https://www.science.org/doi/abs/10.1126/science.aaw6974

track to meet its 2030 and 2050 Global Warming Solutions Act (GWSA) targets and that transportation-sector emissions remain a key obstacle to achieving the GWSA targets.[65] This underscores that implementation of the policy is essential to meeting the GWSA targets: 45 percent emission reductions below 2001 by 2030, and the 2050 target of 80 percent emission reductions.

Our analysis finds that Connecticut's adoption of the ACC II vehicle standards will result in total estimated emission reductions between 2022-2050 of 137 million metric tons (MT) of carbon dioxide equivalent (CO_2e), 68,700 metric tons of nitrogen oxides (NO_x), 800 metric tons of sulfur dioxide (SO_2), 3,400 metric tons of fine particulate matter (PM2.5), and 81,100 metric tons of Volatile Organic Compounds (VOCs).

Table 11. Estimated Avoided Emissions from Connecticut's Light-Duty Vehicles (2022-2050)

Pollutant Emissions Source	CO_2 ($MtCO_2e$)	Unit
Carbon Dioxide (CO_2)	136,966,000	$MtCO_2e$
Nitrous Oxides (NO_x)	68,700	Metric Tons (MT)
Sulfur Dioxide (SO_2)	800	Metric Tons (MT)
Particulate Matter (PM2.5)	3,400	Metric Tons (MT)
Volatile Organic Compounds (VOCs)	81,100	Metric Tons (MT)

Note: Data based on assumption of a 14.841-year average vehicle life and 13,476 average annual vehicle miles (VMT)[66] Emission calculations based on data from U.S. DOE Office of Energy Efficiency and Renewable Energy[67] and the U.S. Energy Information Administration[68] and assumes a carbon-free electricity grid to charge vehicles by 2040, per Connecticut legislation.[69]

These avoided CO_2 emissions are the pollution equivalent of 3.5 billion tree seedlings grown for 10 years, based on U.S. EPA figures.[70] The avoided emissions of the other four pollutants will have multiple personal and societal benefits as detailed in the next section on societal benefits.

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[65] Connecticut Department of Energy and Environmental Protection, Electric Vehicle Roadmap for Connecticut, 2020.

[66] *How Many Miles Does a Car Last?,* Car and Driver (June 11, 2020), https://www.caranddriver.com/research/a32758625/how-many-miles-does-a-car-last/; *Average Annual Miles per Driver by Age Group*, Federal Transportation Administration, https://www.fhwa.dot.gov/ohim/onh00/bar8.htm; Emission figures from EBP's TREDIS Software Data-Sources-and-Default-Values (March 2022) based on U.S. DOT's *Benefit-Cost Guidance for Discretionary Grant Programs,* https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf#:~:text=This%20document%20is%20intended%20to%20provide%20applicants%20to,benefits%20and%20costs%20of%20a%20potential%20infrastructure%20project.

[67] U.S. Department of Energy, *Beyond Tailpipe Emissions: Results*, https://www.fueleconomy.gov/feg/Find.do?year=2022&vehicleId=43955&zipCode=06838&action=bt3.

[68] U.S. Energy Information Administration, State Electricity Profiles, https://www.eia.gov/electricity/state/archive/2018/connecticut/.

[69] S.B. No. 10, Session year 2022, *An Act Concerning Climate Change Mitigation*, https://www.cga.ct.gov/asp/cgabillstatus/cgabillstatus.asp?selBillType=Public+Act&which_year=2022&bill_num=5.

[70] U.S. Environmental Protection Agency, Greenhouse Gases Equivalencies Calculator, Calculations and References, https://19january2017snapshot.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references_.html.

Societal Benefits

While the emission of carbon dioxide and other harmful pollutants is largely invisible, the personal and societal impacts of these emissions are extensive, consequential and, in some cases, irreversible. The benefits of pollution emission reductions, range from human physical health impacts to food and water security to property and infrastructure impacts to ecosystem and biodiversity impacts. Table 12 categorizes and discusses the primary societal impacts and includes academic study references for each.

Table 12. Societal Impacts of Avoided Carbon and Key Pollutant Emission Reductions

Societal Impact	Description	Reference
Temperature	Heat stress is a leading cause of weather-related human mortality. As temperatures increase due to climate change, heat stress is expected to worsen.	Interactions between urbanization, heat stress, and climate change | SpringerLink
Health and Productivity	Climate change will increase the impact of heat stress on people who work outside or in hot workplaces.	Occupational heat stress assessment and protective strategies in the context of climate change | SpringerLink
Air Quality (PM 2.5)	Air pollution significantly affects human health and climate change is a driver of increased air pollution.	The Interplay of Climate Change and Air Pollution on Health | SpringerLink
Pandemic Disease	Infectious respiratory diseases such as COVID-19 can be affected by climatic and environmental factors, including temperature, humidity, and air pollutants.	Climate change, environmental factors, and COVID-19: Current evidence and urgent actions (cell.com)
Vector-Borne Disease	Vector-borne diseases (e.g., West Nile virus) are sensitive to weather and climate conditions, with increasing temperature and more variable weather increasing their incidence.	Climate change and vector-borne diseases: what are the implications for public health research and policy? | Philosophical Transactions of the Royal Society B: Biological Sciences (royalsocietypublishing.org)
Human Cognition	There is now substantial evidence that permanent exposure to CO_2 levels predicted by the end of the century will have significant effects on humans. Reduced thinking ability and health symptoms have been observed at CO_2 levels above 600 ppm.	Carbon dioxide toxicity and climate change: a major unapprehended risk for human health. (grapevine.com.au)
Social Equity	Climate change will dramatically reduce job opportunities or cause major employment shifts in sectors	The Climate Gap | 17 | Inequalities in How Climate

Societal Impact	Description	Reference
	that predominately employ low-income people.	Change Hurts Americans (taylorfrancis.com)
Intergenerational Equity	Today's carbon emissions will negatively impact today's children as they get older, along with impacting future generations.	Climate Change and Intergenerational Justice | Tracey Skillington | Ta (taylorfrancis.com)
Food Security	The impacts of climate change are a growing threat to agriculture and overall food security.	Climate Change, Agriculture and Food Security: Impacts and the Potential for Adaptation and Mitigation - ScienceDirect
Water Security	Water is vital for human and animal survival and is the primary medium through which the impacts of climate change will be felt.	Measuring water security: A vital step for climate change adaptation - ScienceDirect
Water Quality	Impaired water quality is a global and growing problem, limiting resources for drinking, domestic use, food production, and recreation.	Study role of climate change in extreme threats to water quality | Nature
Drought	Climate change-driven drought is a highly destructive hazard with wide-ranging impacts on food and water security and human health.	A scoping review of drought impacts on health and society in North America | SpringerLink
Wildfires	Higher temperatures and altered precipitation patterns caused by climate change will intensify wildfire risk through the entire U.S.	Forests | Free Full-Text | Assessing Climate Change Impacts on Wildfire Risk in the United States (mdpi.com)
Flooding	Increasing temperatures amplify the atmosphere's water holding capacity and increase the occurrence of extreme precipitation events.	Recent trends in U.S. flood risk - Slater - 2016 - Geophysical Research Letters - Wiley Online Library
Coastal Property	The combined forces of climate change and coastal development have the potential to increase hurricane damage in the U.S. and around the globe.	Projected Increases in Hurricane Damage in the United States: The Role of Climate Change and Coastal Development - ScienceDirect
Infrastructure	Climate change impacts on electricity grid infrastructure is projected to be significant.	Climate change impacts and costs to U.S. electricity transmission and distribution infrastructure - ScienceDirect
Climate Migration	Climate change has the potential to uproot and displace millions of people, and American cities are on the frontline of these future population shifts.	Vulnerable City, recipient city, or climate destination? Towards a typology of domestic climate migration impacts in U.S. cities | SpringerLink

Societal Impact	Description	Reference
Fish And Shellfish	Climate change poses a threat and risk to world fisheries, aquaculture, and seafood security.	Climate change impacts on tropical and temperate fisheries, aquaculture, and seafood security and implications - A review | Request PDF (researchgate.net)
Coastal Wetlands	Coastal wetlands provide significant protection against flood and hurricane damage.	The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA | Scientific Reports (nature.com)
Carbon Storage	Climate change is reducing the capacity of natural sinks to store carbon, for example in oceans, tropical rainforests and boreal forests.	Climate change and carbon sink: a bibliometric analysis | SpringerLink
Biodiversity	Carbon emissions and climate change are a major and growing driver of biodiversity loss globally.	Mapping co-benefits for carbon storage and biodiversity to inform conservation policy and action | Philosophical Transactions of the Royal Society B: Biological Sciences (royalsocietypublishing.org)
National Security	Carbon emission impacts and climate change will pose new challenges for U.S. national security.	The National Security Impacts of Climate Change 10 Journal of National Security Law and Policy 2019-2020 (heinonline.org)
Mental Health	Climate change causes human psychological impacts such as anxiety, stress, depression, and increases in aggression.	Climate Change and Mental Health: AJN The American Journal of Nursing (lww.com)
Crime	A growing body of research suggests a correlation between rising temperatures and increased crime.	Climate Change and Crime Revisited: An Exploration of Monthly Temperature Anomalies and UCR Crime Data - Dennis M. Mares, Kenneth W. Moffett, 2019 (sagepub.com)

With this comprehensive suite of carbon emission and climate change impacts, we have a much more complete picture of the negative personal and societal impacts that can be reduced by implementing carbon emission reduction policies today.

Monetization of Societal Benefits

Multiple studies conclude that climate *inaction* will cost significantly more than climate *action* taken now.[71, 72] The basic economic dynamic is clear, and how much less *action* will cost is a matter of degree determined by which risk factors are being considered and quantified. Monetization of the costs of action or inaction can be accomplished in two ways, by monetizing individual avoided impacts and summing them, or by employing a social cost of carbon (SCC) figure developed using an integrated assessment model (IAM) or other modeling tool. The former is a reductionist approach while the latter represents a more holistic way of monetizing climate action benefits. The SCC is the marginal cost of the impacts of emitting one metric ton of carbon dioxide equivalent into the biosphere and includes impacts on human health, ecosystems, and other factors that do not have a market price. For this report we are using a SCC approach.

The valuation of the SCC varies dramatically according to which 'social impacts' are included, and the calculation method applied to determine the costs of these impacts. The range of SCC in the academic studies and reports reviewed varied from $53/ton, the current U.S. Federal rate, to over $800/ton, the high range of several studies.[73,74] The IPCC suggests that a carbon price from $135 to $5,500/t$CO_2$ in 2030, and from $245 to $13,000 in 2050 (2010 U.S. dollars), would be needed to drive carbon emissions to stay below the 1.5°C limit.[75] In this report we are using the SCC figure developed by the neighboring state of New York, $125 per metric ton,[76] and adjusting it up by 25 percent to $156 per metric ton to account for the avoided impacts of not crossing irreversible climate tipping points that lead to self-reinforcing climate feedback loops and/or cascade to accelerate other tipping point risks (e.g., Amazon rainforest tipping into a net carbon emitter; carbon feedback loops leading to a *hot house earth* state).[77]

The next consideration is the discount rate, which takes into account the reduced value of money in the future, and which also discounts the value of investments made today for the benefit of today's children and future generations. Suggested discount rates range from 0 percent to over 7 percent. Again, we are using the New York State Department of Environmental Conservation's recommended discount rate of 2 percent in our SCC calculations. For the impact of the other four pollutants considered, NO_x, SO_2, PM2.5, and VOCs, we use the U.S. Department of

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[71] The New Climate Economy, The 2018 Report of the Global Commission on the Economy and Climate, https://newclimateeconomy.report/2018/.

[72] *The Turning Point: A New Economic Climate in the United States,* Deloitte (January 2022), https://www2.deloitte.com/content/dam/Deloitte/us/Documents/about-deloitte/us-the-turning-point-a-new-economic-climate-in-the-united-states-january-2022.pdf.

[73] Jarmo S. Kikstra et al, The social cost of carbon dioxide under climate-economy feedbacks and temperature variability, Environmental Research Letters (2021), https://iopscience.iop.org/article/10.1088/1748-9326/ac1d0b.

[74] Ricke, K., Drouet, L., Caldeira, K. et al., *Country-level social cost of carbon,* Nature Climate Change 8, 895–900 (2018), https://doi.org/10.1038/s41558-018-0282-y.

[75] Global Warming of 1.5 ºC, SR15, Chapter 4, Strengthening and Implementing the Global Response, p.374, IPCC (2018), https://www.ipcc.ch/sr15/chapter/chapter-4/.

[76] NYSDEC Value of Carbon Guidance 2022 Update, p.34, https://www.dec.ny.gov/docs/administration_pdf/vocguid22.pdf.

[77] Simon Dietz et al, *Economic impacts of tipping points in the climate system*, PNAS (August 16, 2021), https://www.pnas.org/doi/10.1073/pnas.2103081118.

Transportation's recommended 7 percent discount rate since the primary effects of these pollutants is more immediate.

The total value of societal benefits attributable to the EV requirements included in the ACC II policy between 2022-2050 is approximately $31.5 billion, while the value by 2035 is $4.9 billion. Table 13 provides a detailed breakdown of these values.

Table 13. Estimated Avoided Emission Costs from Connecticut's Light-Duty Vehicles (2022-2050)

Pollutant Emissions Source	Avoided Emission Costs (Billions)
Carbon Dioxide (CO_2)	$27.06
Nitrous Oxides (NO_x)	$1.24
Sulfur Dioxide (SO_2)	$0.039
Particulate Matter (PM2.5)	$2.96
Volatile Organic Compounds (VOCs)	$0.19
Total Avoided Costs	**$31.49**

Medium and Heavy-Duty Trucks

It is anticipated that by 2035, heavy-duty vehicles will emit 61 percent more NO_x emissions than light-duty vehicles (LDVs) due to reduced LDV emissions from stronger new vehicle emission standards.[78] Therefore it will be essential to transition the Connecticut medium and heavy-duty (MHD) vehicle fleet to ZEVs to ensure the state can meet its emission reduction targets.

In 2020, Connecticut joined 14 other states and the District of Columbia in signing a memorandum of understanding (MOU) which provides a framework to coordinate state efforts to meet MHD electrification goals. The MOU stipulates working toward 100 percent ZEV MHD vehicles by 2050, and 30 percent by 2030.[79] The vehicles addressed in the MOU include large pickup trucks and vans, delivery trucks, box trucks, transit and school buses, and long-haul delivery trucks. In 2021, Governor Lamont issued Executive Order 21-3, which directed state agencies to take actions to reduce carbon emissions and address the climate crisis. The Executive Order directed DEEP to "Assess the need to adopt California Medium and Heavy-Duty (MHD) vehicle emissions standards. DEEP shall assess the need to adopt the California Air Resources Board (CARB) standards for MHD vehicles as part of the state's efforts to meet air quality and climate change goals." [80] In 2022, DEEP released a white paper which found that adoption of California MHD standards would substantially reduce criteria pollutant and GHG

[78] Connecticut Department of Energy and Environmental Protection, *Electric Vehicle Roadmap for Connecticut*, (2020).
[79] Multi-State Medium- and Heavy-Duty ZEV MOU (July 2020), https://portal.ct.gov/-/media/DEEP/air/mobile/EVConnecticut/2020-07-14---Mulit-State-MHD-ZEV-MOU.pdf.
[80] Connecticut Executive Order No. 21-3 (December 16, 2021), https://portal.ct.gov/-/media/ConnecticutClimateAction/NML_EO_21-3-_Website_Text_Actions.pdf.

emissions, create economic benefits, and lead to lower health care costs in Connecticut.[81] The Connecticut legislature subsequently passed Public Act 22-25, which authorized DEEP to adopt regulations implementing the California MHDV standards and establish a voucher program to support the purchase of zero-emission MHDVs and provides a timeline for the electrification of the state's bus and school bus fleets.[82]

In July 2022, the Northeast States for Coordinated Air Management's (NESCAUM) ZEV Task Force release their Multi-State Medium and Heavy-Duty ZEV Action Plan, which provides a policy framework to eliminate harmful truck and bus emissions and provide for a just and equitable transition to ZEVs.[83] As noted above, one of the strategies that Connecticut is pursuing is the adoption of California's Advanced Clean Trucks Rule (ACT) which is a manufacturers' ZEV sales requirement and a one-time reporting requirement for large entities and fleets.[84] With the ACT regulation, manufacturers of Class 2b-8 are required to sell an increasing percentage of ZEVs from model years 2026 to 2035. The ACT targets start in 2026 at 10 to 13 percent, depending on truck class, and ramp up to 40 to 75 percent by 2035.

GHG emission reductions with the ACT regulation over the 2026 to 2035 period are estimated at 15.3 $MMTCO_2$, representing a 32.3 percent reduction over the business-as-usual baseline (see Figure 3).[85]

[81] Connecticut Department of Energy and Environmental Protection, *An Assessment of Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emission Standards* (March 8, 2022). https://portal.ct.gov/-/media/DEEP/air/mobile/MHD/MHD_Whitepaper_030822.pdf.

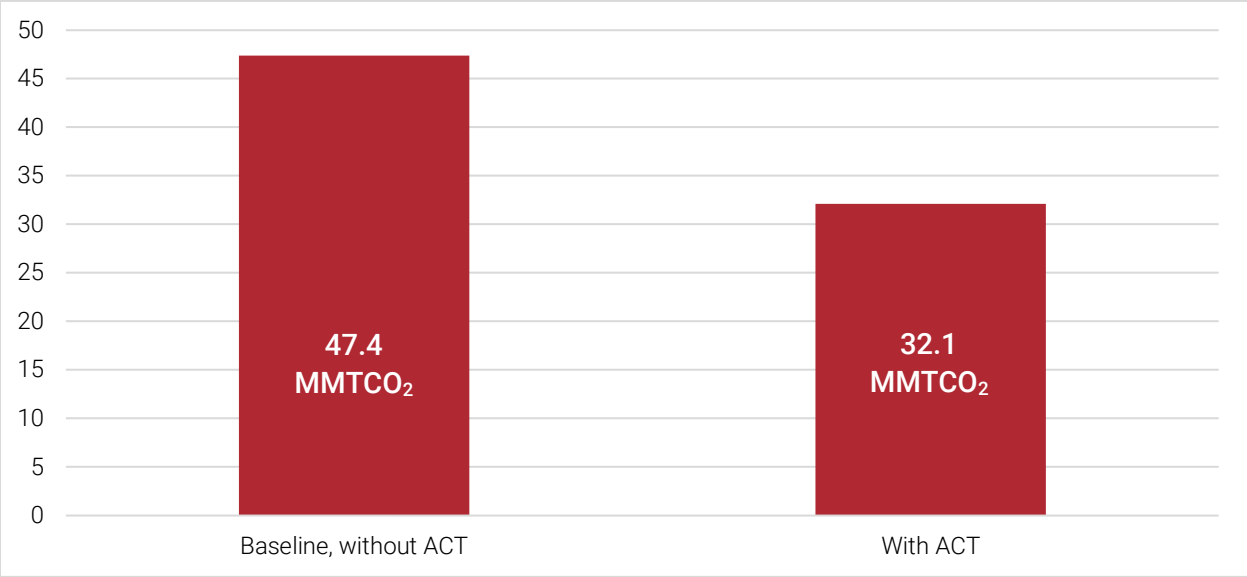
[82] Public Act 22-25, An Act Concerning The Connecticut Clean Air Act (May 10, 2022), https://www.cga.ct.gov/2022/act/pa/pdf/2022PA-00025-R00SB-00004-PA.pdf.

[83] *Multi-State Medium- and Heavy-Duty ZEV Action Plan*, NESCAUM (July 2022), https://www.nescaum.org/documents/multi-state-medium-and-heavy-duty-zev-action-plan-dual-page.pdf.

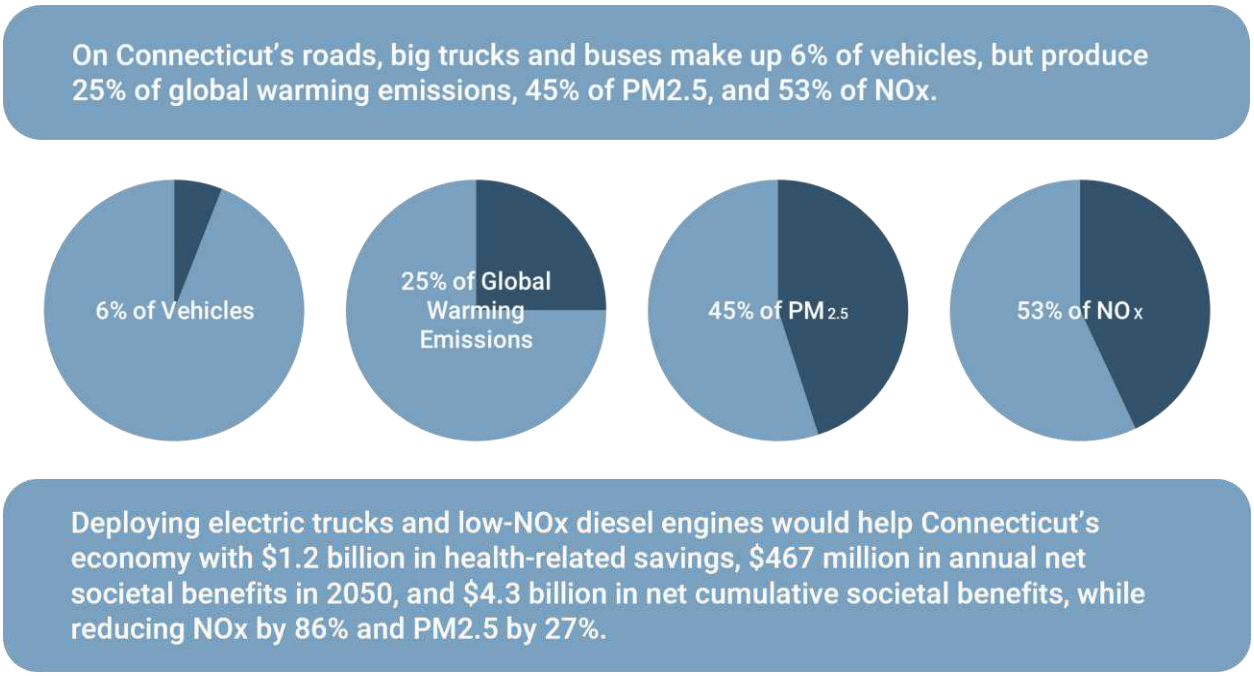
[84] Advanced Clean Trucks, California Air Resources Board, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks.

[85] Data from 2018 Connecticut GHG Inventory and NESCAUM's 2022 Multi-State Medium- and Heavy-Duty Zero-Emission Vehicle Action Plan.

Figure 3. Baseline CO_2 Emissions from Connecticut Trucks Compared with CO_2 Emissions with the Advanced Clean Trucks Rule (ACT) (2026-2035)



Reducing diesel emissions in Connecticut is vital to improving air quality and public health in underserved and overburdened communities, and to supporting local and regional economic development and job growth. In January 2022, the Union of Concerned Scientists published a short paper on the benefits to Connecticut of adopting ACT.[86] Two of the key takeaways include:



[86] Connecticut Clean Trucks Fact Sheet, Union of Concerned Scientists, (January 2022), https://www.ucsusa.org/sites/default/files/2022-01/ct-clean-trucks-fact-sheet.pdf.

As with the Advanced Clean Cars II policy, adoption of California's Advanced Clean Trucks regulation in Connecticut will benefit the state's public health, environment, and economy.

Hydrogen and Large Trucks

While the consensus of opinion is that hydrogen is not the best alternative fuel for light-duty vehicles, and in most cases medium-duty as well, hydrogen may make the most sense from a decarbonization and economic perspective for large, long-haul trucking, although the economic case is not fully established.[87] Compared to equivalent battery-powered trucks, the lesser weight and bulk of on-board hydrogen storage, allows for larger loads. The higher energy density of hydrogen may allow for longer intervals between stops. Additionally, as with other electric vehicles the simpler engine structure should result in more reliable, less expensive maintenance over the life of the truck. For owners of commercial trucking the combined costs of ownership and operation is the key metric.

In March 2022, the National Renewable Energy Laboratory (NREL) published *Decarbonizing Medium and Heavy-Duty On-Road Vehicles: Zero-Emission Cost Analysis,* a study looking at the economics of medium and heavy-duty trucking, including ICE (Diesel), battery electric and fuel cell vehicles at a range of sizes and uses.[88] The metrics examined using the TEMPO model included upfront vehicle cost, fuel costs (vehicle fuel economy and price), maintenance costs, vehicle usage – miles traveled, discount rate, monetized charging time cost for BEVs, and logit formulation to capture heterogeneous factors. Noting that fuel costs and infrastructure are large variables, the study's major conclusions are:

Improvements in zero-emission vehicle technologies (BEV and FCEV) and fuels in line with U.S. DOE targets, and vetted with industry, enable ZEVs to achieve cost parity with diesel by 2035. Two ZEV tech solutions and pathways for many applications provide more options and mitigate risks:

- BEVs tend to become cost-competitive for almost all light-medium and medium trucks before 2030 and for short-haul (<500-mile) heavy trucks before 2035.
- Hydrogen FCEVs tend to become cost-competitive for long-haul (>500-mile) heavy trucks by 2035.
- Buses can fully transition to ZEV (100 percent sales) by 2030.[89]

These assumptions need proving in the real world and there are pilot programs in various stages of development and operation. The Alberta, Canada, Motor Transport Association will have Canada's first on the road test for long haul trucks by the end of 2022.[90] Several manufacturers

[87] The Hydrogen Economy: For Light Vehicles, Hydrogen Is Not For this Decade, S&P Global Ratings (2022), https://www.spglobal.com/ratings/en/research/articles/210422-the-hydrogen-economy-for-light-vehicles-hydrogen-is-not-for-this-decade-11911374.

[88] National Renewable Energy Lab, Decarbonizing Medium and Heavy-Duty On-Road Vehicles: Zero-Emission Cost Analysis (March 2022), https://www.nrel.gov/docs/fy22osti/82081.pdf.

[89] *Id.*

[90] Hydrogen Commercial Vehicle Demonstration Program, Alberta Motor Transport Association, https://amta.ca/what-we-do/hydrogendemos/.

including Volvo, Toyota, Daimler and Hyundai are in various stages of developing on the road testing.

As noted previously in 'EV Forecast and Economic Analysis,' Connecticut is a national leader in fuel cell technologies and is well positioned for expanded economic development opportunities related to the use of hydrogen fuel cells in long-haul trucking.

Conclusions

This study and report have detailed the multiple economic impacts and societal benefits associated with Connecticut adopting California's Advanced Clean Cars II ZEV requirements. The conclusion is that the economic impacts and societal benefits are compelling and significant, and that the absence of the policy would jeopardize achieving Connecticut's clean air and carbon emission reduction goals and efforts to improve public health.

Connecticut has a major opportunity to benefit economically from a transition to EVs. The proposed policy will spur EV adoption, which will generate positive economic impacts for households, manufacturers, and service companies throughout the state. Connecticut can also grow its economy beyond the direct effects of EVs by capitalizing on new economic development opportunities around EV-related technologies like energy storage, electrical components manufacturing, and charging station design and manufacturing.

Estimated net economic impacts, benefits and avoided emission costs attributable to adopting ACC II are in Table 14. Economic impacts represent changes in the flow of money in the Connecticut economy, whereas societal benefits have economic value in terms of avoided costs.

Table 14. Estimated Net Economic Impacts, Benefits and Avoided Emission Costs from Connecticut's Light-Duty Vehicles, 2022-2050 (29-Year Total in Billions of Constant 2021 Dollars)

Economic Impacts and Societal Benefits from Connecticut 100% EV Sales Policy	Value of Benefits and Impacts (Billions)
Added Net Business Income (Economic Impact)	$40.1
Value Added (GDP) Growth in Connecticut (Economic Impact)	$25.7
Value of Criteria Pollutant Emission Reductions (Societal Benefits - Local)	$4.4
Value of Carbon Emission Reductions (Societal Benefits – Global)	$27.1

Table 15 highlights key messages and talking points that call out the economic impacts and societal benefits of the 100 percent EV sales policy between 2022 and 2050.

Table 15. Key Conclusions, 29-Year Effect from 2022-2050 (Billions of Constant 2021 Dollars)

Key Conclusions
$40 billion in net business income (economic impact).
$26 billion in net value added or GDP (economic impact).
128,200 net new job-years, representing about 4,400 more jobs than would otherwise exist each year.
$4 billion in value of criterial pollutant emission reductions (societal benefits - local).
$27 billion in value of carbon emission reductions (societal benefits - global).
$42 billion in gross vehicle fuel cost savings.
$15 billion in gross vehicle operating and maintenance cost savings.
Carbon emission reductions of 137 million metric tons CO_2.
Carbon emission reduction equivalent of planting 3.5 billion trees.
Improved air quality from pollution emission reductions of NO_x (68,681 metric tons), SO_2 (796 metric tons), PM2.5 (3,418 metric tons), and VOCs (81,080 metric tons)
The policy will unlock new opportunities for economic development around EV-related technologies.
The policy will ensure Connecticut stays economically competitive by capturing market share in EV-related industries sooner than other states.
Failure to adopt the ACC II policy would jeopardize achieving Connecticut's public health, clean air, and emission reduction goals.
Due to the EV content provisions of the Inflation Reduction Act, full implementation is likely to be slowed, making Connecticut's state-level incentives even more important in the current and near-future EV transition.