ENERGY ACTION NETWORK

2019 ANNUAL PROGRESS REPORT

for VERMONT

From EAN's Executive Director & Board Chair

This Annual Progress Report for Vermont shares where our state stands relative to our emissions reduction and renewable energy commitments. It also outlines strategies to meet these goals in ways that improve our economy and advance equity. For the first time, we are providing an expanded emissions analysis that compares Vermont to our regional neighbors; a comprehensive economic impact analysis of the consumer savings and statewide economic benefits of our Path to Paris; a series of case studies of effective policies from around the region and world; and action profiles of EAN members who are leading the way here in Vermont.

Vermont's latest greenhouse gas emissions inventory showed that our emissions went down from 2015 to 2016, marking the first time that our state has achieved a year to year reduction in climate pollution since 2011. In addition, our research shows that as of 2018 Vermont has the cleanest electricity in the entire country and the second lowest rates in New England.

This foundation of **an increasingly renewable, low-carbon electricity sector provides us with a golden opportunity to achieve unparalleled emissions reductions and economic savings by electrifying our transportation and thermal sectors.** And because a far higher share of dollars spent on electricity, rather than fossil fuels, stays and recirculates in the state, this transformation will boost our local and state economies.

As shown in our analysis of latest available emissions data (2016) for the northeast region, **Vermont has the highest per capita GHG emissions, has made the least progress toward the Paris climate commitment, and is the only state in the region that has failed to reduce emissions below its 1990 levels.** Vermont's transportation sector is the primary culprit: our reliance on fossil fuels in this sector is at 95% and our per capita vehicle miles traveled is higher than any other state in the region.

The progress in our electric sector was achieved because Vermont created a strong policy and regulatory framework, especially the Renewable Energy Standard, which sent clear market signals and required certain targets to be met. **What Vermont needs now is a comprehensive policy and regulatory framework that addresses fossil fuel use in the transportation and thermal sectors.** If we set enforceable policy targets now, we might still meet Vermont's 2025 Paris climate commitment, and our Comprehensive Energy Plan goal to reduce emissions 40% below 1990 levels by 2030.

We know that ending fossil fuel use as quickly as possible is a moral imperative and our social and environmental responsibility. The good news is that we now have the technology to do so in a way that brings economic benefits to all Vermonters and can reduce the health and energy burdens on our most vulnerable citizens. But this transformation will not happen at the pace or scope necessary unless the state adopts a Total Energy policy framework that includes binding commitments to increase renewable energy use and lower emissions simultaneously in all three energy sectors.

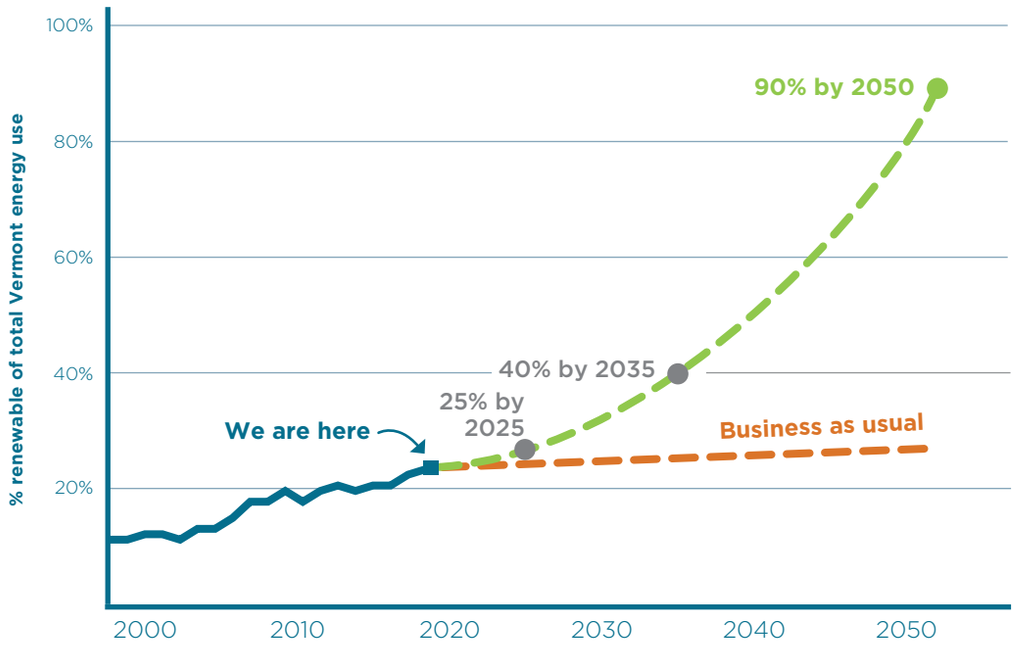
Jared Duval
Executive Director

Leigh Seddon
President

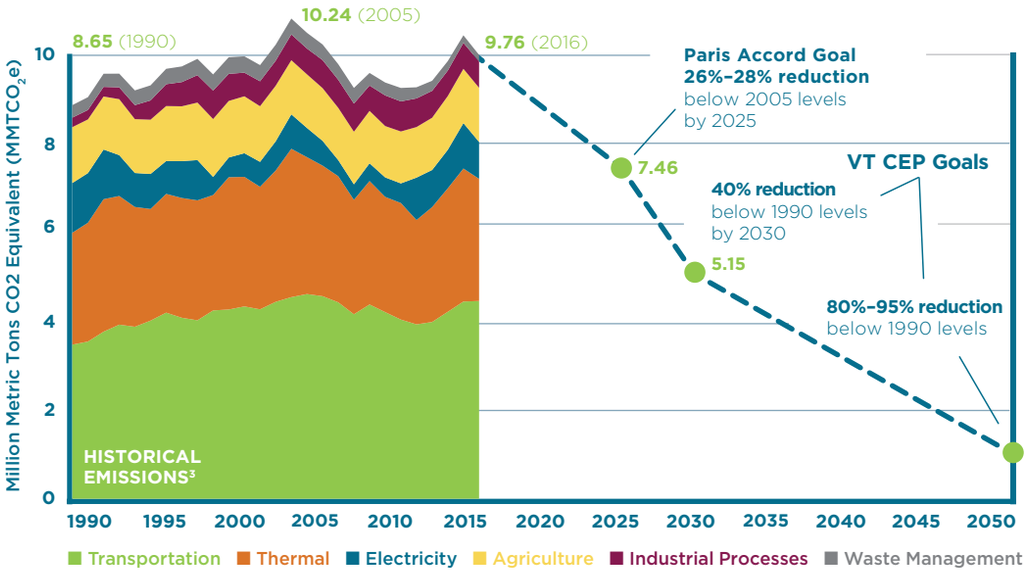
1. Bold action is needed to meet Vermont's energy and emissions commitments

The Energy Action Network and the State of Vermont share a commitment to achieving the goals set forth in Vermont's 2016 Comprehensive Energy Plan (CEP), including having 90% of our total energy use come from renewable sources by 2050. **The increasing renewability of our electricity sector has brought us very close to achieving the first CEP milestone — 25% renewable by 2025.**[2] This represents real and important progress. However, reaching 90% by 2050 will require far more progress in the transportation and thermal energy sectors.

Business as usual will not get us to 90% by 2050[1]



Now is the time for rapid emissions reductions beyond the electricity generation sector



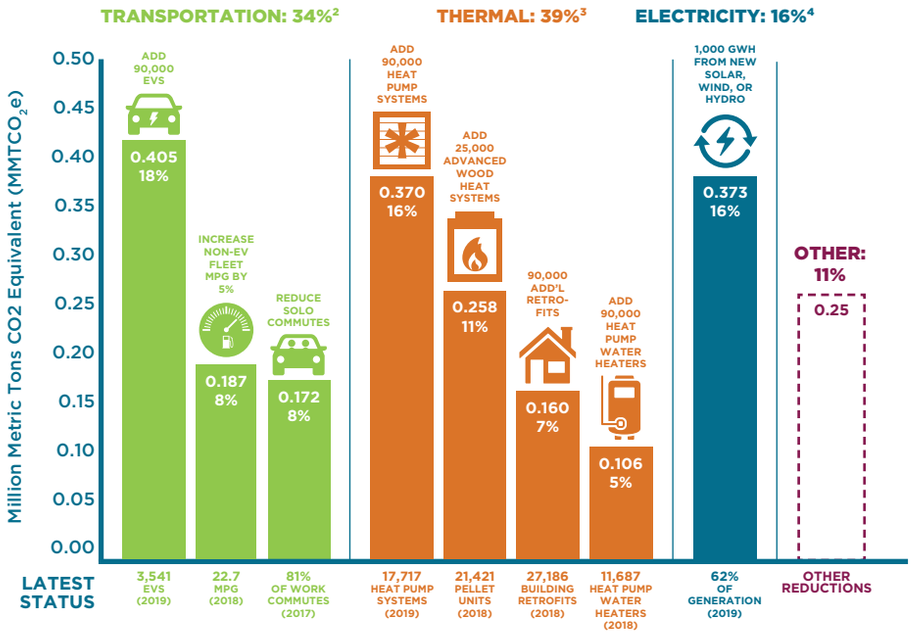
After trending upward between 2010 and 2015, Vermont's greenhouse gas (GHG) emissions finally began declining in 2016. **However, as of 2016, we are still 13% above our 1990 levels.** Almost 60% percent of the reduction in statewide GHG pollution in 2016 came from a decrease in the use of fuel oil and propane for home and building heating, largely due to a warmer winter. Vermont's increasingly clean electricity sector also played an important role in the decline and was responsible for 40% of the reduction in statewide emissions from 2015-2016. Forecasts for 2017 and 2018 show that electricity sector emissions will continue to experience a durable and precipitous decline—to 83 percent below 1990 levels by 2018—primarily due to Vermont's Renewable Energy Standard, which went into effect in 2017 and requires an increasingly clean and renewable electricity supply through 2032.[4] The RES should help get us more than a quarter of the way toward meeting our commitment to the Paris agreement.

1. Vermont Department of Public Service. 2016 Comprehensive Energy Plan. **2.** Vermont Department of Public Service. 2016. Comprehensive Energy Plan 2016. **3.** Vermont Agency of Natural Resources. Department of Environmental Conservation: Air Quality and Climate Division. January 2020. 2019 Greenhouse Gas Emissions Inventory Brief (1990-2016). **4.** Vermont Department of Public Service. 2020. Annual Report on the Renewable Energy Standard.

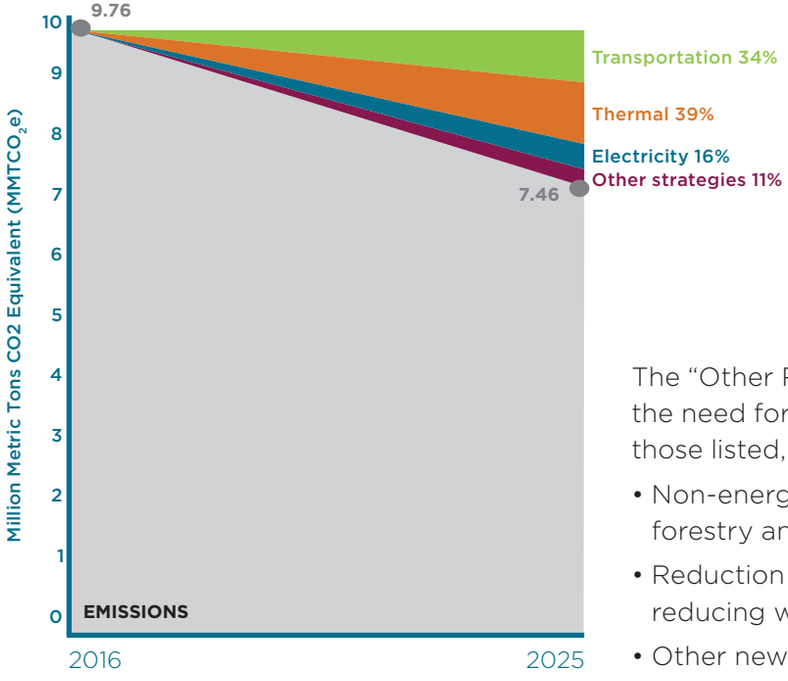
2. We have the technology and know-how

In our 2018 report, EAN modeled one path that Vermont could take to reduce emissions and meet our commitment to the Paris Climate Agreement using currently available energy technologies and proven best practices. The model builds upon original targets set in the Comprehensive Energy Plan and increases them proportionally to meet our emissions reduction target. For this year's report, we have updated the model to account for decreased emissions between 2015 and 2016.

2.3 MMTCO2e reduction by 2025 is required to meet the Paris Agreement[1]



Making Sense of Emissions: 1 million metric tons of CO2 is the equivalent of burning 114 million gallons of gasoline — or of driving 216,000 passenger cars for one year. So the nearly 10 million metric tons VT emitted in 2016 is a huge number — the equivalent of burning over 1 billion gallons of gasoline or of driving over 2 million passenger cars for 10,000 miles.



Getting to Paris will require ALL these efforts

In the chart to the left, you can see how all these strategies collectively reduce emissions leading up to our 2025 target. If Vermont puts fewer than 90,000 EVs on the road, for example, we would have to make up the difference elsewhere to meet our goal.

The "Other Reductions" section of the model above recognizes the need for additional carbon reduction strategies beyond those listed, including:

- Non-energy related strategies such as carbon sequestration in forestry and agriculture
- Reduction in energy consumption due to conservation and reducing waste
- Other new products or efficient technology advancements

1. Vermont Agency of Natural Resources. January 2020. **2.** Transportation data is the latest available from the Energy Information Administration (EIA) (2019), Vermont Agency of Transportation/UVM Transportation Research Center (2019), and Drive Electric Vermont (Oct 2019).**3.** Thermal data from EIA (2019), Efficiency Vermont (2019), Department of Public Service (2019), Biomass Energy Research Center (2019), Department of Forests, Parks & Recreation (2019). **4.** Electric data from the Department of Public Service (2019) and ePUC (Certificates of Public Good: September 2019).

3. Getting off fossil fuels is good for Vermont's economy

Over the last decade, **Vermont has spent an average of about $2 billion a year on fossil fuels, with 75% of those dollars draining right out of state.** For context, Vermont's entire Gross State Product was approximately $33 billion in 2018.

Average annual fossil fuel spending in VT, 2008–2017

The Vermont Agency of Commerce and Community Development (ACCD) estimates that **if Vermont achieves the scale and pace of energy transformation modeled in EAN's "Path to Paris" for the transportation and thermal sectors, we will reduce the amount of dollars sent out of state by over $1 billion** between 2020–2035, primarily as a result of buying less fossil fuels.[1] We would also increase direct investment in the VT economy by about $323 million, primarily from increased investments in weatherization.

Economic impacts of EAN's Path to Paris, 2020–2035

DECREASE in out-of-state spending:
$1.115 billion

INCREASE in in-state investment:
$323 million

Net consumer savings:
$792 million

Since Vermont imports 100% of the fossil fuel we use, the vast majority of the money we spend on fossil fuels (up to 80 cents of every dollar, depending on the fuel) leaves the state. In contrast, **all of the efficient and renewable alternatives keep a much higher share of our energy dollars recirculating in Vermont, helping employ our neighbors and improving our state economy.**

It's good news for Vermont consumers too

For the Vermonters who take these efficient and renewable energy actions, individual savings will vary but could be nearly $10,000 per household from 2020–2035, or over $650 per year.[2]

All together, if the transportation and thermal actions in EAN's Path to Paris were completed at scale by 2025, the Vermonters who undertake them are **projected to save a total of nearly $800 million between 2020-2035.** To achieve this, from here on out we have to stop purchasing new gas and diesel vehicles and new fossil fuel heating systems. We need as many as possible of the approximately 12,500 heating system replacements per year in Vermont to be renewable and as many as possible of the 35,000 to 40,000 new vehicles purchased in VT each year to be EVs.

Total savings for a VT household: Nearly $10,000

Vermonters who opt for an EV instead of a gas vehicle or install a cold climate heat pump heating system to displace fossil fuel use save money over the lifespan of the investment because of the low and stable prices that electricity offers.

An equitable transition

While some Vermonters have the means to make more climate-responsible purchasing decisions that will save them money in the long run, many others lack the funds to make the up-front investment to change their vehicle or heating system. That is why, to ensure an equitable energy transition, it is imperative that assistance—from incentives to low-interest financing—is provided to lower and middle income Vermonters, so that we can all benefit from the savings this transition offers.

1. Vermont Agency of Commerce and Community Development. 2020. Dollar Figures in Present Value, 2020 dollars. **2.** Assumes purchasing a new EV instead of a new fossil fuel vehicle, installing a multi-head cold climate heat pump system (36,000 BTU) to displace 75% of fossil fuel use for home or building heating, and replacing an old electric water heater with a heat pump water heater. Savings are lifetime savings (2020-2035) represented in 2020 dollars.

4. Vermonters can reduce their emissions and save money

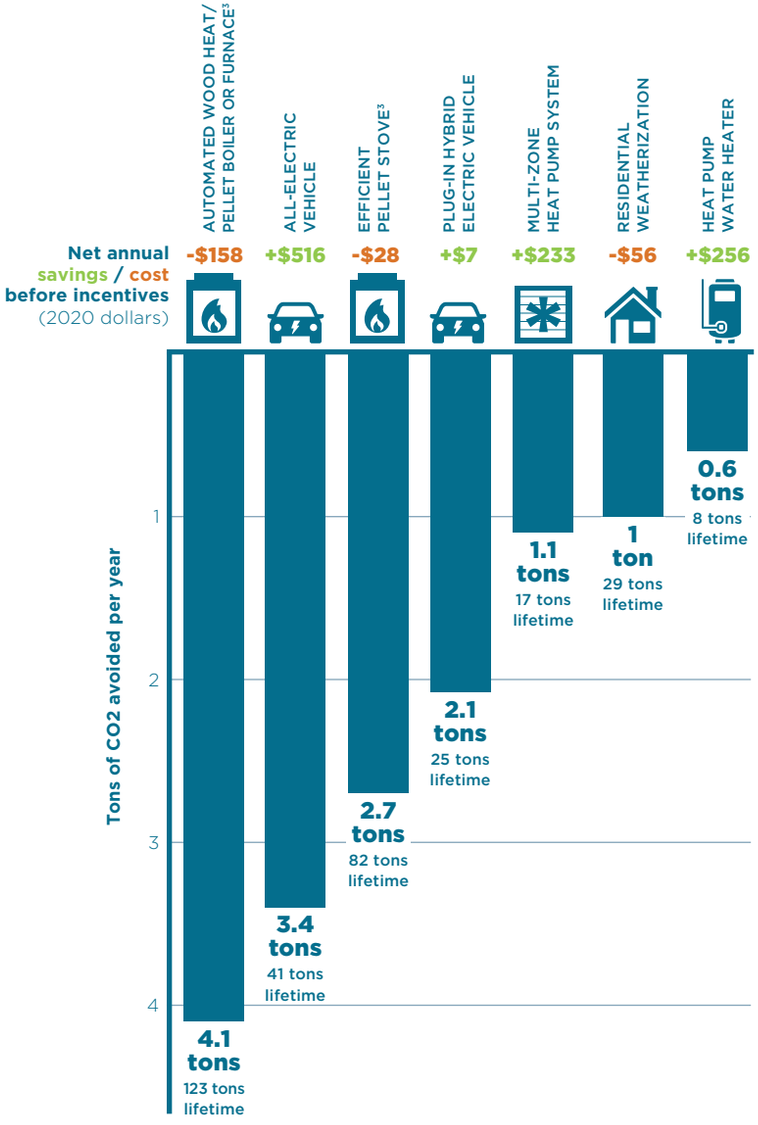
On average, each Vermonter is responsible for over 15 tons of GHG pollution per year.[1] Fossil fuel use is the primary driver of these emissions. The biggest single source of our pollution comes from how much and in what kind of vehicle(s) we drive. The average Vermonter is responsible for between 5-6 tons of carbon emissions from driving, with those who drive more miles and/or less efficient vehicles being responsible for the most pollution and those who primarily walk/bike or use public transit being responsible for the least.

The next largest source of GHG pollution comes from how we heat our homes and buildings, with the average Vermonter responsible for 4-5 tons of GHG emissions, with those who heat inefficiently and/or with fuel oil, propane, or natural gas responsible for the most pollution and those who heat efficiently, especially with advanced wood heating technology or cold climate heat pumps, responsible for the least.

Average annual VT emissions, per capita: 15.6 tons CO2e

If this cloud were the actual volume of the average annual emissions of a Vermonter, it would be 150 yards in diameter, or wider than one and a half football fields.

Individual $ savings & GHG reductions from energy actions[2]



It's simple: fossil fuels are the problem and most of our fossil fuel use is from vehicles and heating systems. For those Vermonters who have the means, investing in one or more of these actions can reduce emissions in a cost effective way. For those who don't have the means, existing and additional incentives are necessary, both practically speaking and in the interest of equity. Both ACCD and the Public Service Department have found that our fossil fuel dependence is much more costly to Vermonters and the Vermont economy than the efficient and renewable alternatives, even without accounting for the "social costs" of greenhouse gases, from health impacts to other "externalities."

We have already reached the point where, even on a direct cost/benefit basis, the majority of the time it saves you money and improves the Vermont economy to invest in weatherization, purchase an electric vehicle instead of a new fossil fuel vehicle, install a heat pump water heater, and choose cold-climate heat pumps and/or efficient wood heating systems instead of installing new fossil fuel heating systems.

1. Vermont Agency of Natural Resources. January 2020. To align with international standards, every state or country that conducts a GHG inventory uses a "sector-based" approach that accounts for the emissions that occur within the boundaries of its territory. This approach avoids double-counting of emissions in reporting to bodies like the United Nations' Intergovernmental Panel on Climate Change (IPCC). However, we also know that when we purchase goods and services, our consumer demand makes us responsible for emissions throughout a supply-chain, back to the sources of where and how they were produced. That is why some states — including Minnesota and Oregon — supplement their official "sector-based" GHG inventory with a "consumption based emissions inventory" (CBEI), to provide a fuller view of how its state is responsible for climate pollution. Vermont currently only utilizes a sector-based inventory. However, based on the results of other consumption-based emissions inventories, it is very likely that no matter how you measure Vermont's emissions, the two largest sources of our climate pollution come from vehicles and heating appliances. **2.** Sources: Household Savings: Agency of Commerce and Community Development, Tons of CO2 Avoided: Public Service Department. **3.** Assumes, as the State of Vermont does, that wood is a carbon neutral fuel source. Also assumes use of wood pellets sourced from the Northeast. If you prefer the life-cycle emissions calculation approach, as utilized by SIGNAL on pg. 22, the tons of CO2 avoided figures for wood heat presented here might decrease by half. Either way, locally sourced wood pellets are a much less carbon intensive heating source than fuel oil, propane, or natural gas.

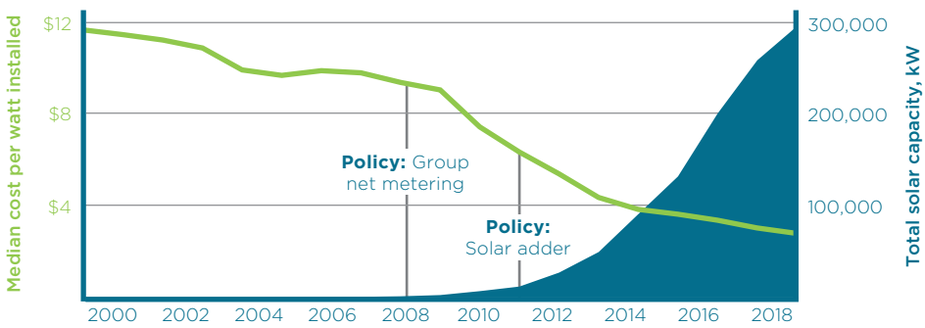
5. We need a total energy policy framework

In 2019, EAN brought together the Vermont Energy Future Initiative, a diverse, cross-sector group of leaders to explore how Vermont can meet its 2025 total energy and emissions reduction commitments while creating a more just, thriving, and sustainable future for Vermonters. The group concluded that **what is most needed at this crucial point in time is a total energy policy and regulatory framework that covers transportation and thermal as well as electricity.**

Policy + technology can lead to rapid change

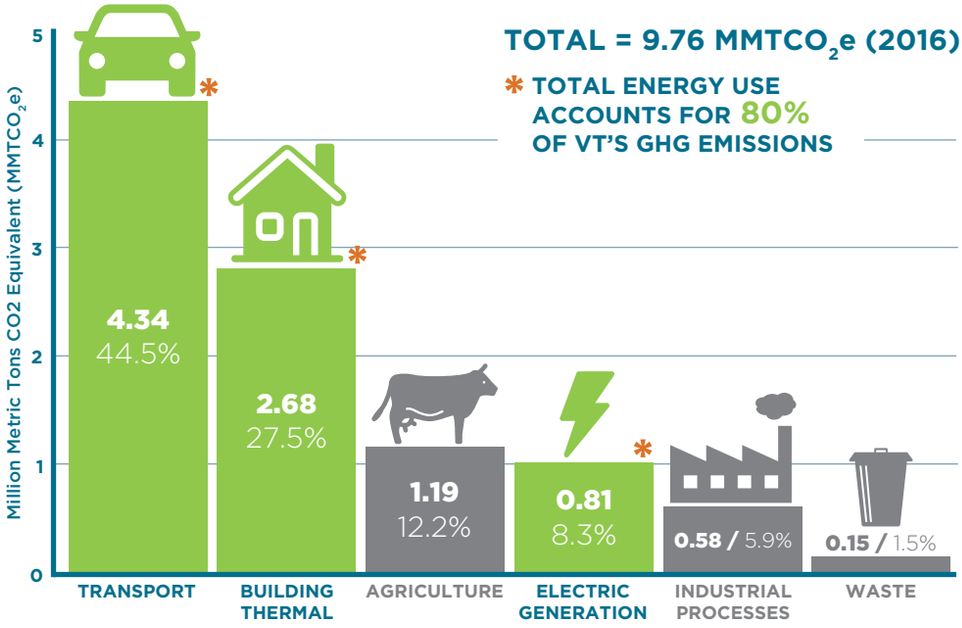
Members of the Initiative explored the history of the transformation of Vermont's electricity sector, which shows that maturing renewable energy technology, coupled with the adoption of a policy and regulatory framework (such as Standard Offer, Net Metering, and the RES) that provides concrete goals, can drive a very rapid transition in our market economy. The group looked at similar case studies of transformation in the transportation sector in Norway and in the thermal sector in Upper Austria. In each case, **once a baseline of technological capability existed, the next key intervention that unlocked progress was a policy and regulatory framework** that mandated certain targets be met, sending clear market signals to spur rapid adoption of clean technology.

Decreasing costs and new policy support rapid growth of solar in VT[1]



Expanding success in the electricity sector to the transportation and thermal sectors

Vermont's GHG emissions by sector[2]

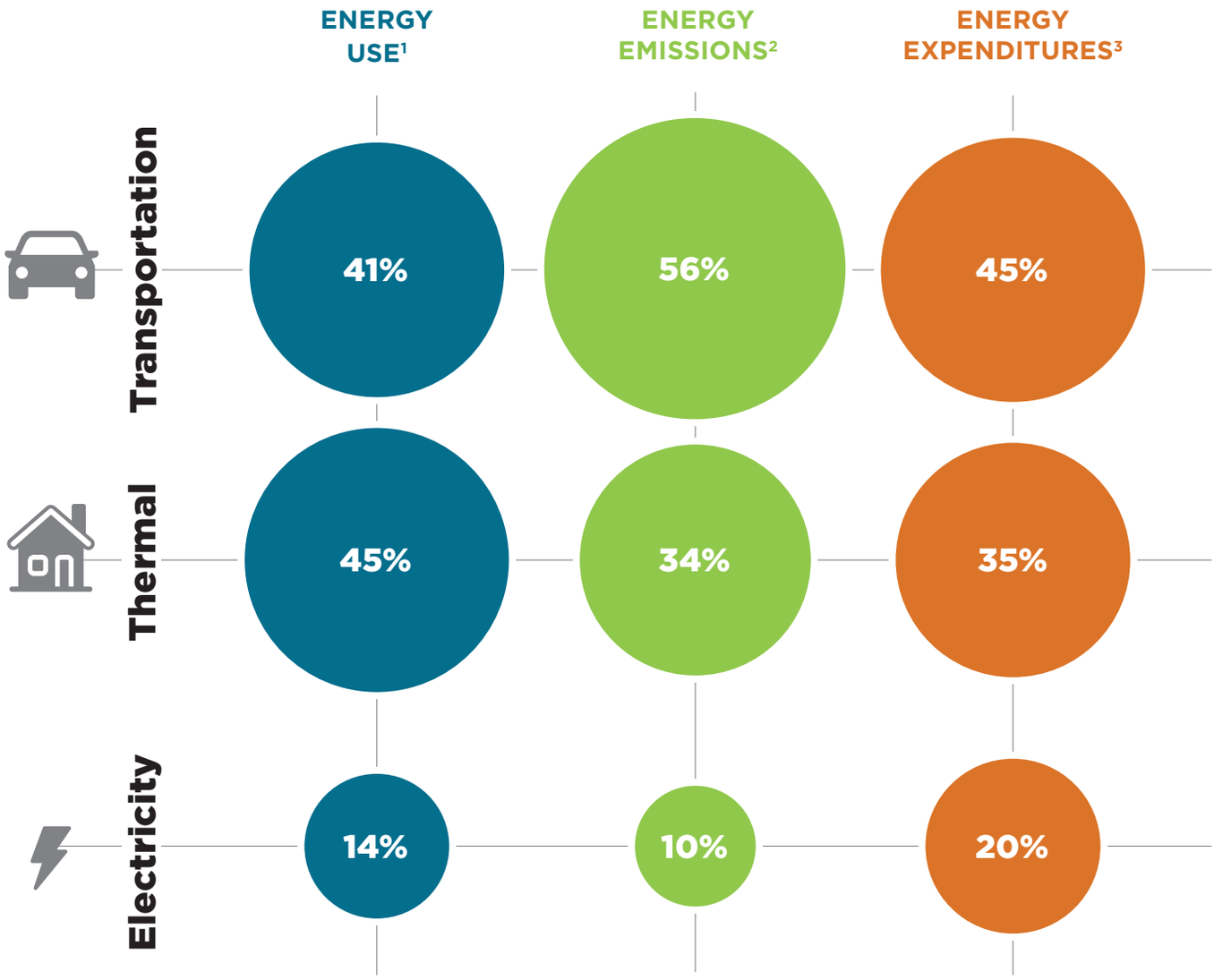


One of the greatest barriers to meeting our renewable energy and emissions reduction commitments is that Vermont policy and regulatory requirements are primarily focused on just one of our energy sectors: electricity generation. However, our continued use of fossil fuels to meet our transportation and thermal energy needs means that overall emissions continue to increase, with these two sectors currently accounting for over 70% of Vermont's GHGs. To meet our goals, **Vermont needs to create the policy and regulatory framework to require fossil fuel reduction, promote efficiency, and invest in the adoption of efficient and renewable transportation and heating alternatives, especially for low-income Vermonters** who might not be able to access them.

1. Vermont Community Energy Dashboard and Lawrence Berkeley National Laboratory. 2019. **2.** Vermont Agency of Natural Resources. January 2020.

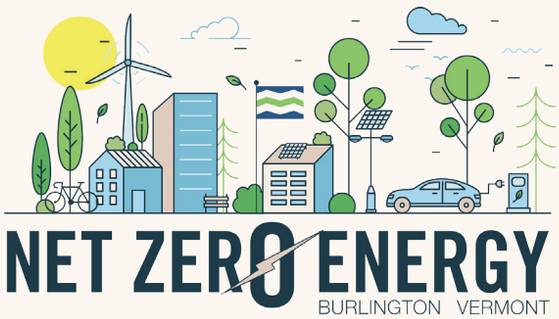
What do we mean by 'total energy'?

Often discussions of renewable energy begin and end with electricity generation, but Vermonters use far more energy to get around and to heat and cool our buildings. **A total energy transformation requires tackling electricity, transportation, and thermal energy.** In fact, whether you look at relative energy used, emissions produced from energy sources, or energy expenditures (share of total energy costs for Vermonters), transportation and thermal pose the biggest challenge.



1. Thermal and transportation based on EIA 2017 site energy; electricity based on Department of Public Service 2018 site energy after accounting for RECs. **2.** Vermont Agency of Natural Resources. January 2020. **3.** Efficiency Vermont. October 2019. Vermont Energy Burden Report.

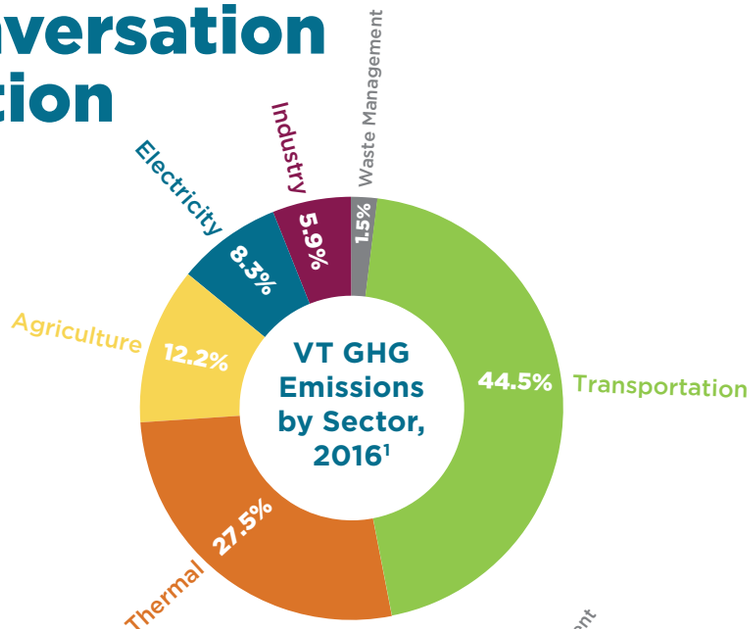
ACTION PROFILE: **Burlington Net Zero**



Burlington, the nation's first city to source 100% of its electricity from renewable energy, has laid out **a roadmap to achieve net zero energy (NZE) in the thermal and ground transportation sectors.** Released by Mayor Miro Weinberger and the Burlington Electric Department (BED), the NZE Roadmap includes: electrifying thermal in 40% of commercial floor space and 95% of households; switching 80% of cars to electric; building district energy to serve 40% of commercial floor space, and decreasing household vehicle miles traveled by 15%. Along with the Roadmap release, BED announced new incentives for pre-owned EVs, heat pumps, and efficient water heaters.

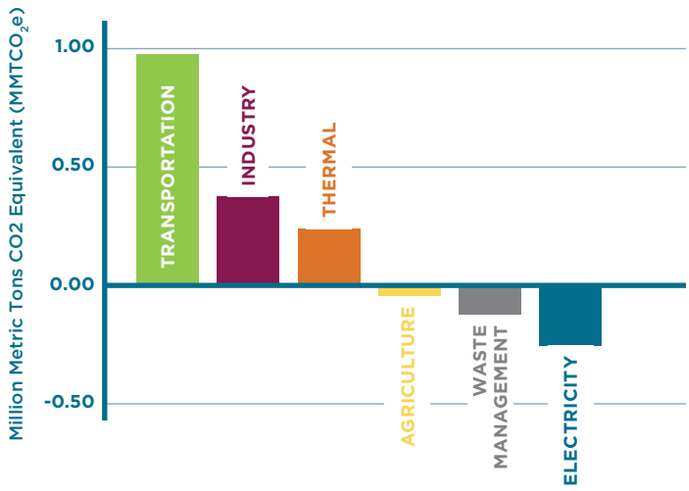
Vermont's climate conversation is an energy conversation

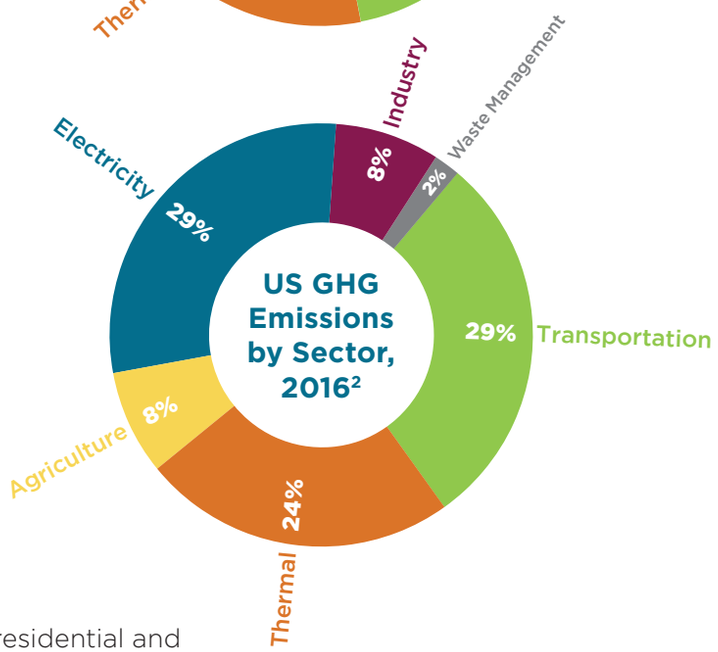
Reducing Vermont's greenhouse gas emissions to do our part to fight the climate crisis and transforming our total energy use to be more efficient and renewable are deeply interrelated. **Our two biggest sources of emissions come from how we get around (transportation) and how we heat and cool our homes and businesses (thermal), which together cause over 70% of Vermont's climate pollution**. This means the challenge in VT is different than at the national level, where the majority of emissions come from transportation and electricity generation.



Moving in the wrong direction

Total net change in VT GHG emissions, 1990 vs 2016:[1] 1.11 MMTCO2e





Compared to a 1990 baseline, emissions from transportation, residential and commercial fuel use, and industrial processes have increased. Emissions from electricity consumption, waste management, and agriculture have declined. This data reinforces the point that as we continue our progress in the electric sector, we have to increase our focus on transforming our transportation and thermal sectors.

1. Vermont Agency of Natural Resources. January 2020. **2.** US EPA. 2019. US Inventory of Greenhouse Gas Emissions and Sinks: 1990–2017.

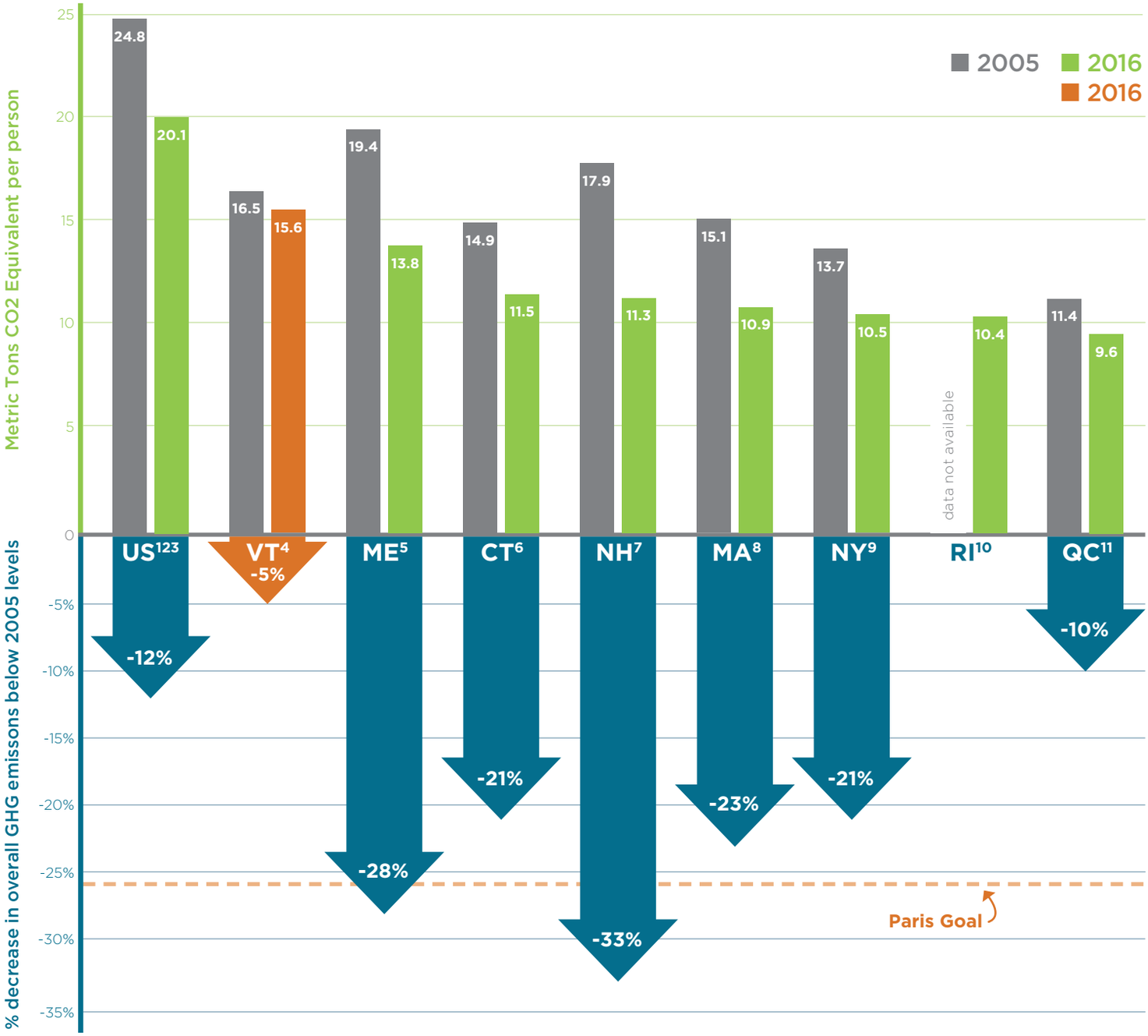
ACTION PROFILE: VEEP Youth Climate Leaders Academy

The Youth Climate Leaders Academy prepares, supports, and empowers high school students to become the agents of change needed to address the climate crisis. Through this program, the Vermont Energy Education Program and other community partners support high school students to undertake projects in their schools, communities, or statewide that protect the environment and enhance stewardship of Vermont's natural resources. Through this work, **young people develop the skills, confidence, and knowledge to continue their work as climate leaders** and move towards career paths that make a positive difference in our energy and climate future. More than 160 VT youth have been part of the program since 2017.

How Vermont stacks up to the region on emissions

Vermont has the highest per capita GHG emissions in the region, at over 15 tons of pollution per person. Maine comes in second highest (at 13.8 tons per capita). Emissions in every other state are less than 12 tons per person. All states in the region — including VT — are below the US average of 20.1 tons per capita. When you compare 2005 emissions to the most recent data from 2016, **Vermont has made the least progress towards the Paris Climate Agreement of any state in the region.**

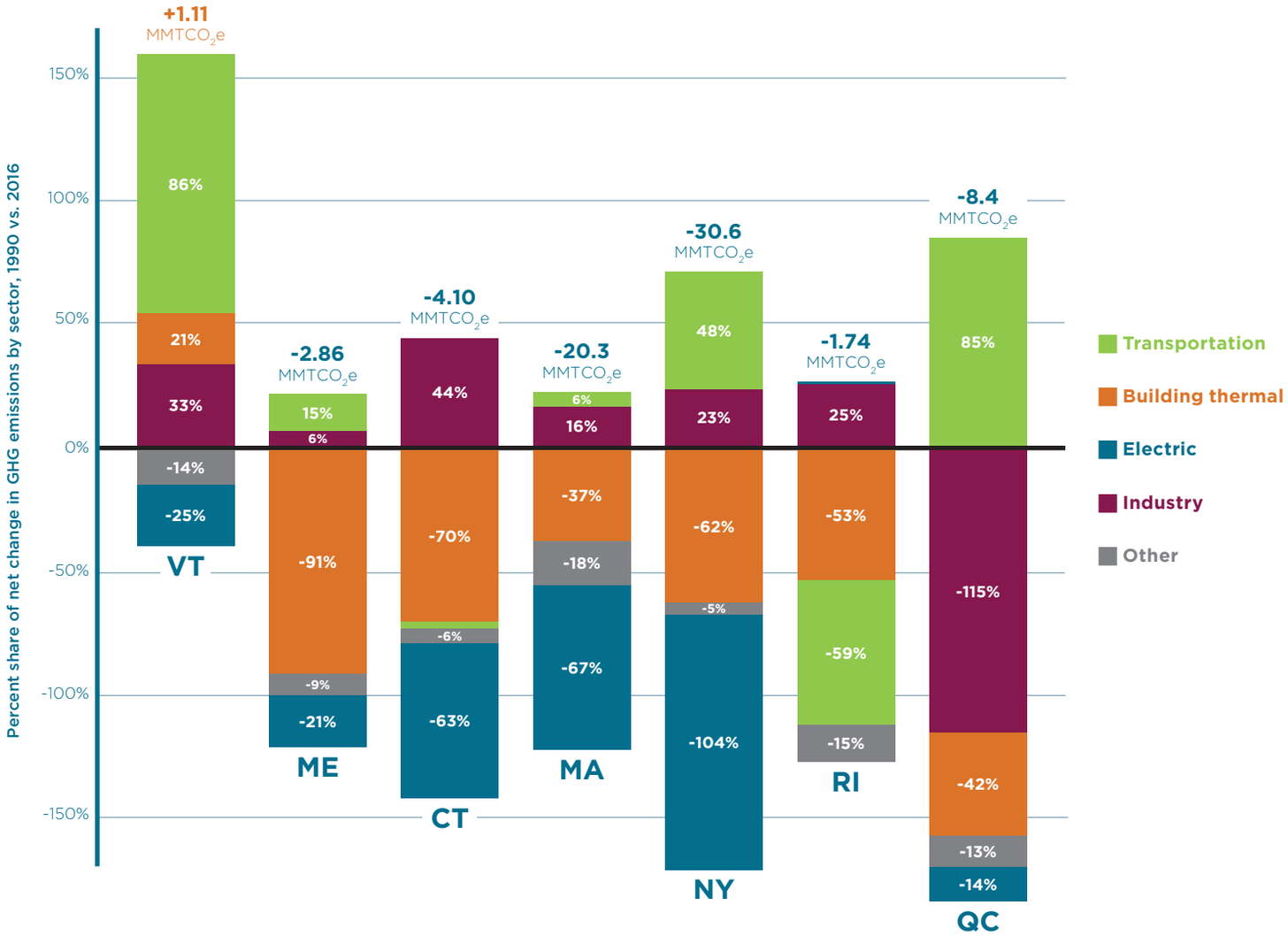
Comparing per capita emissions and progress to Paris across the region, 2005 vs. 2016



1. US EPA. 2019. US Inventory of Greenhouse Gas Emissions and Sinks: 1990–2017. **2.** United States Census Bureau. December 2019. **3.** United States Census Bureau. July 2010. **4.** Vermont Agency of Natural Resources. 2019 Greenhouse Gas Emissions Inventory Brief (1990-2016). **5.** Maine Department of Environmental Protection. January 2020. **6.** Connecticut Department of Energy and Environmental Protection. 2018. **7.** New Hampshire Department of Environmental Services. 2020. **8.** Massachusetts Executive Office of Energy and Environmental Affairs. 2019. **9.** New York State Energy Research and Development Authority. July 2019. **10.** Rhode Island Department of Environmental Management. 2019. **11.** Canada, Government of. 2019.

Our neighbors are making more progress than we are

Where emissions increases and decreases have come from across the region, 1990 vs. 2016[1]

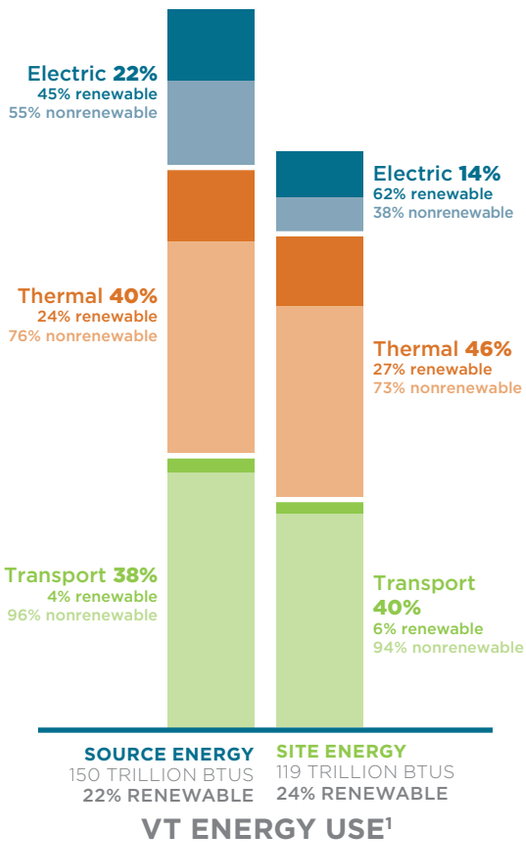


For most states, the biggest decline in emissions since 1990 baselines has come from cleaning up their electricity sources. This is true for Vermont too — but **the impacts of RGGI and the Renewable Energy Standard in helping reduce emissions from the electricity sector have been dwarfed by the increase in emissions due to higher fossil fuel use for transportation and building heating.** Specifically, our net increase in the share of emissions from transportation and thermal increased by more than any other state in the region.

The silver lining is that as of 2018 **Vermont now has the cleanest electricity in the entire country.**[2] That means that when we electrify our transportation and thermal sectors, **we can get greater emissions reduction from strategic electrification**. Every electric vehicle, cold climate heat pump, or heat pump water heater brought into service in Vermont will not only run more efficiently than outdated fossil fuel alternatives — they will also create fewer emissions (near-zero) than anywhere in the country.

1. State and provincial emissions inventories (see footnotes on page 10). **2.** EAN analysis.

What's our energy footprint?



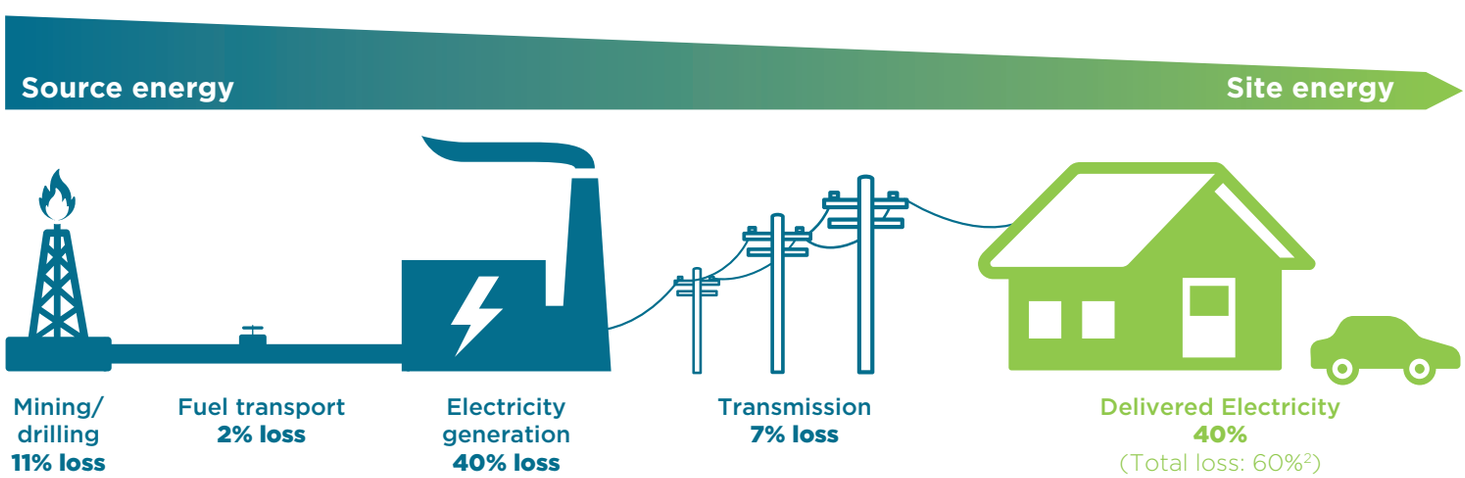
Site vs. source energy

There are two different ways to measure energy use: **Site Energy** is the amount of fuel and electricity directly consumed by a building, vehicle, or appliance. **Source Energy** traces the fuel and electricity used (on site) back to the raw fuel input required to make and deliver that energy. Both measurements are valid, but source energy is the most comprehensive view and enables a complete assessment of energy efficiency and GHG emissions associated with our energy consumption.

On the facing page, we break down each sector in terms of fossil fuel and renewable energy use, looking at both source energy and site energy.

How renewable are we?

Using site energy, Vermont has reached 24% renewable across the three energy sectors[1] and **we are on track to meet the first Comprehensive Energy Plan milestone of 25% renewable by 2025 ahead of schedule.** The majority of this progress has come from the electric sector, with transportation and thermal significantly further behind. Thermal and transportation make up 86% of our energy use and are only 27% and 6% renewable, respectively.

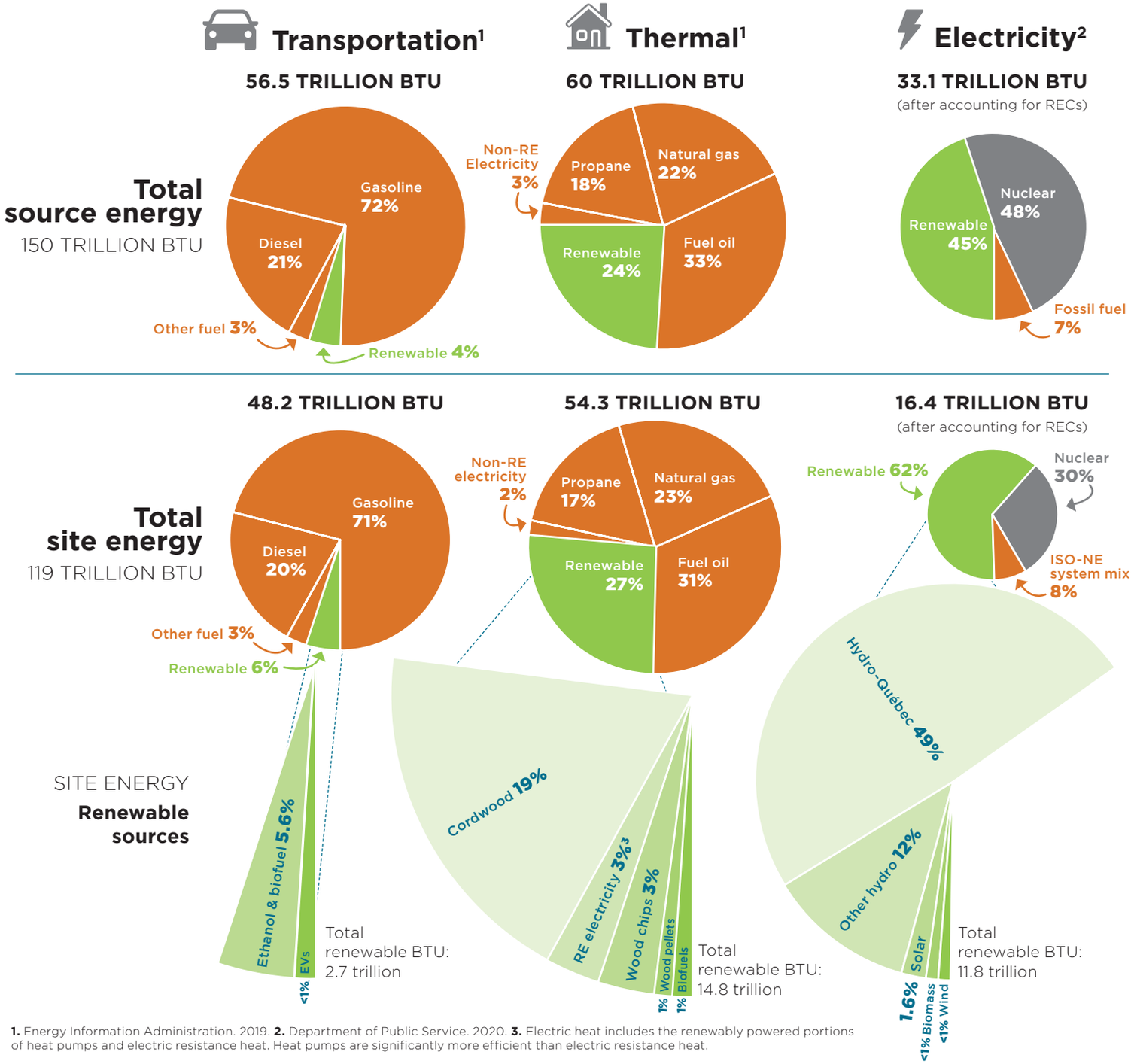


1. Sources for Site Energy: Energy Information Administration (2019), Department of Public Service (2020). Source energy factors from Deru & Torcellini (2007) applied to site energy data to derive Source Energy measurements. **2.** Typical losses for a combined cycle natural gas plant in New England.

ACTION PROFILE: Reducing Peak Demand

Dynamic Organics of Putney is helping businesses around the state find innovative ways to decrease load on the grid during peak times. Peak demand times are when power can be dirtiest and most expensive. Working with Efficiency Vermont and Green Mountain Power, the team discovered that a legacy ice-making system at the Brattleboro Retreat could be repurposed to provide cooling for the buildings. By developing a custom controller and software to manage the system, the Retreat now freezes ice in off-peak, lower energy cost times and uses the chilled air during peak demand times. **This load shifting reduced the Retreat's peak energy demand on the electric grid by more than 115 kilowatts and is saving them $8,000-$10,000 per year.**

Total energy breakdown



1. Energy Information Administration. 2019. **2.** Department of Public Service. 2020. **3.** Electric heat includes the renewably powered portions of heat pumps and electric resistance heat. Heat pumps are significantly more efficient than electric resistance heat.

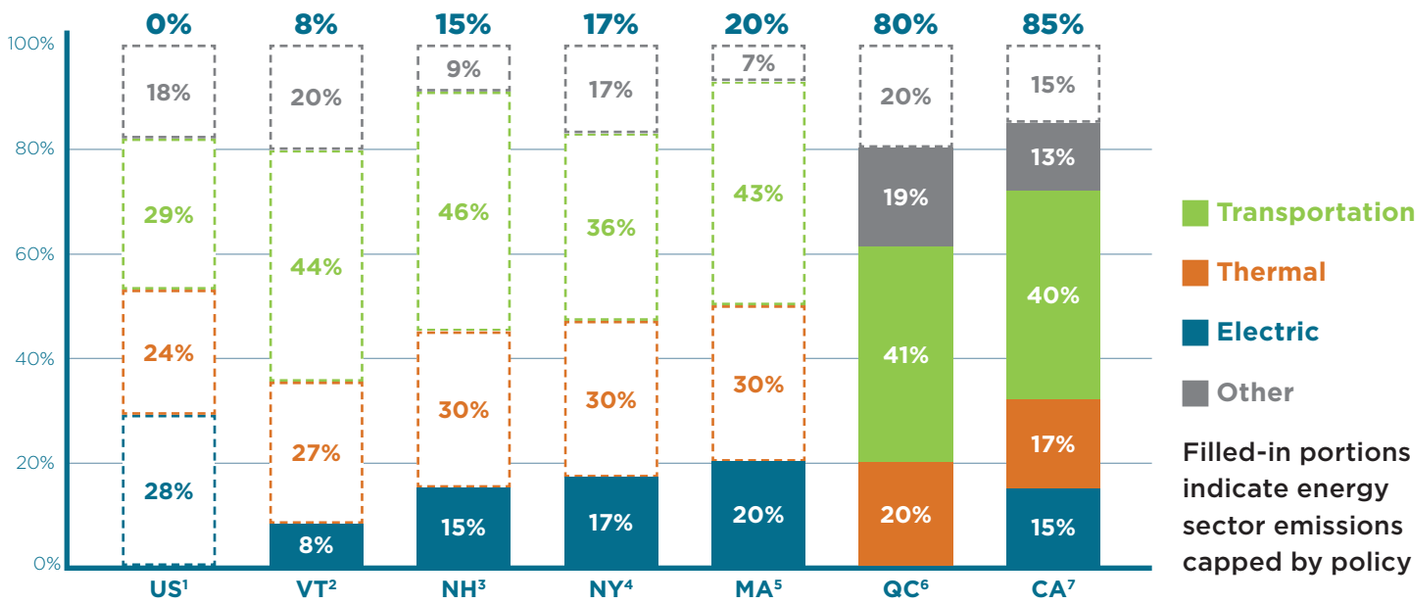
ACTION PROFILE: **Promoting Entrepreneurship and Innovation**

The DeltaClimeVT business accelerator (formerly Accel-VT), managed by the Vermont Sustainable Jobs Fund, convened **a cohort of entrepreneurs in 2019 focused on reducing fossil fuel use and emissions in heating and transportation.** Businesses included Onboard Data, which develops software to help facility managers maximize efficiency and sustainability in commercial buildings; EVmatch, a mobile platform that allows EV drivers to find and reserve underutilized private charging stations on the go; and Go Together, a platform for end-to-end trip planning among trusted networks to schedule carpools, biking, walking, and transit. Three cohort businesses won paid pilot projects to demonstrate their technology with BED and GMP.

A total energy transition requires a total energy policy framework

Vermont is one of eleven US states and two Canadian provinces that participates in some form of cap and invest program. However, the Regional Greenhouse Gas Initiative (RGGI) only caps a small percentage of our total emissions. California and Quebec are members of the Western Climate Initiative (WCI), which caps emissions economy-wide. The chart below shows what sectors are capped by an emissions policy in each region, and what percent of total emissions come from that sector. The case studies on the following pages, and elsewhere throughout the report, highlight policy opportunities to reduce emissions across all energy sectors.

Percent of GHG emissions capped by policy, 2016



1. US Environmental Protection Agency. 2019. US Inventory of Greenhouse Gas Emissions and Sinks: 1990–2017. **2.** Vermont Agency of Natural Resources. January 2020. **3.** New Hampshire Department of Environmental Services. 2020. **4.** New York State Energy Research and Development Authority. 2019. New York State Greenhouse Gas Inventory: 1990–2016. **5.** Massachusetts Executive Office of Energy and Environmental Affairs. 2019. GHG Emissions and Mitigation Policies. **6.** Canada, Government of. 2019. Greenhouse Gas Sources and Sinks, Executive Summary 2019. Quebec emissions from the Quebec Environnement et Lutte contre les changements climatiques. **7.** California Air Resources Board. 2019. California Greenhouse Gas Emissions Inventory. **8.** Vermont Agency of Natural Resources. July 2019. **9.** Abt Associates. January 2017.

POLICY CASE STUDY: Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort by 10 Northeastern and Mid-Atlantic states (CT, DE, ME, MD, MA, NH, NJ, NY, RI, and VT) to reduce carbon dioxide emissions from electricity generation through a regional cap-and-invest system. Vermont has participated in RGGI since 2007 when Governor Douglas signed the RGGI Memorandum of Understanding.

Since 2008:

- RGGI states have generated **$3.2 billion in allowance auction proceeds**, most of which have been invested in energy efficiency and renewable energy programs;[8] and
- RGGI-driven reductions in co-pollutant emissions have resulted in over **$5.7 billion in health and productivity benefits,** including avoided incidences of asthma emergency room visits, nonfatal heart attacks, acute bronchitis, and infant mortality.[9]

Other benefits that have coincided with RGGI implementation include:

- **CO2 emissions from RGGI power plants have fallen by 47%,** outpacing the rest of the country by 90%;
- **Electricity prices in RGGI states have fallen by 5.7%,** while prices have increased in the rest of the country by 8.6%;
- **GDP of the RGGI states has grown by 47%**, outpacing growth in rest of the country by 31%;

Vermont received $19.9 million in proceeds from 2008-16. Programs funded in part by RGGI have served approximately 8,700 Vermont households and 500 Vermont businesses via the Home Performance with ENERGY STAR® service for residential customers, the building performance energy efficiency service for small business customers, and low-income energy efficiency services through 3E Thermal project management. Over 100,000 tons of CO2 and more than $155 million of energy savings for Vermonters are expected to be realized over the lifetime of those investments.

POLICY CASE STUDY: **Transportation and Climate Initiative**

Building on the success of the RGGI model, which has capped and reduced carbon emissions in the power sector and made investments that have saved consumers money, the Transportation and Climate Initiative (TCI) is a regional and bi-partisan collaboration of 12 Northeast and Mid-Atlantic states (CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, and VA) and the District of Columbia that seeks to:

- Improve transportation
- Develop the clean energy economy
- Reduce carbon emissions from the transportation sector.[1]

44% of Vermont's GHG emissions are attributable to transportation and more than half of our energy spending is on transportation.[2]

In December 2018, Vermont joined eight other northeastern states and the District of Columbia as part of the Transportation and Climate Initiative (TCI) to develop a regional cap-and-invest program to:

- Allow Vermont to reduce transportation emissions while keeping the state economically competitive with neighboring states
- Generate revenue for equitable solutions that save money for Vermonters
- Stimulate Vermont's economy, and
- Promote a faster transition away from fossil fuels.

As part of this program, it has been estimated that **Vermont might generate approximately $20 million per year from fees paid by fossil fuel importers.**

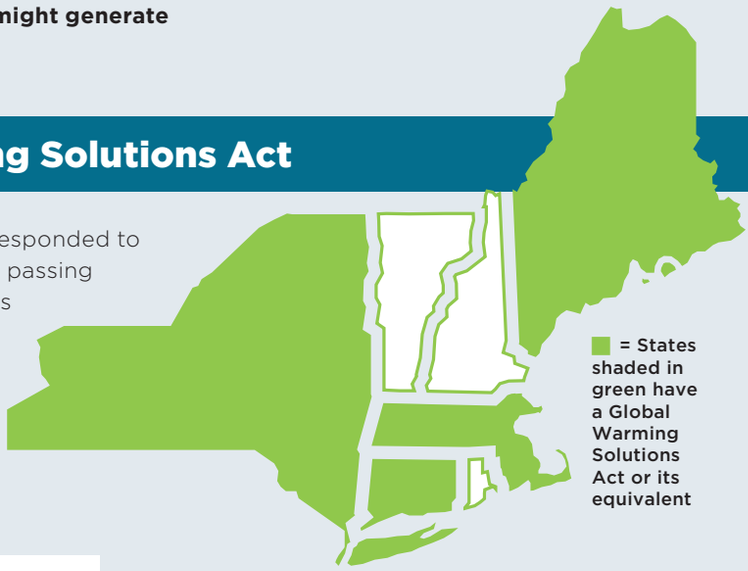
What investments might VT target?

- Incentives for vehicle efficiency programs for Vermonters, including electric vehicles
- Expanded investments in transit and other low-emissions mobility options
- Incentives to advance land use decisions that build on our historic settlement pattern of compact village and urban centers separated by rural countryside, which can help reduce vehicle miles traveled and lead to decreased use of single occupancy vehicles.

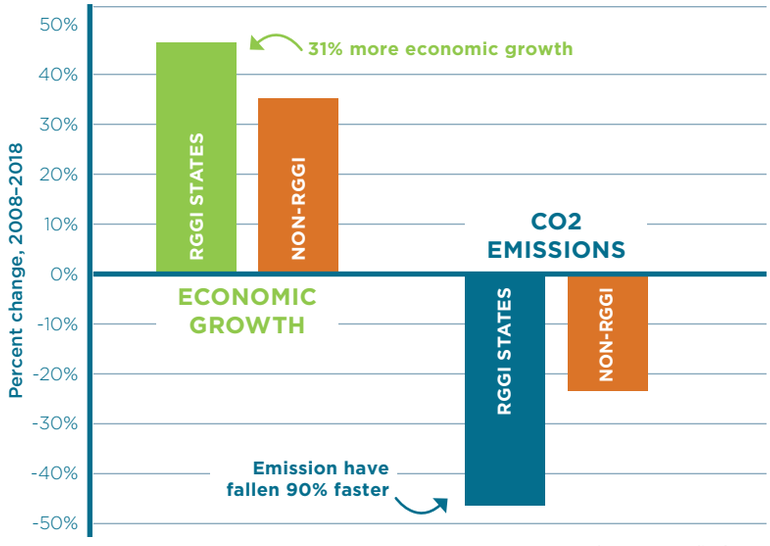
POLICY CASE STUDY: **Global Warming Solutions Act**

While Vermont has set goals for reducing greenhouse gas emissions, we have not yet implemented policy and regulatory requirements to ensure we meet them. In fact, we've consistently missed our emissions reduction targets by wide margins.

Neighboring states, including Massachusetts, Maine, New York, and Connecticut, have each responded to this challenge, in part, by passing Global Warming Solutions Acts: enforceable mandates that turn their goals into requirements.



Economic growth & emissions reductions in RGGI states



Source: Acadia Center. 2019.

Maine's law also created a Climate Change Council to advise the Governor and Legislature on ways to best mitigate and prepare for climate change.

Acts like these have created an accountability mechanism to ensure that states meet their commitments: when Massachusetts, which has one of the most robust climate change laws in the nation, failed to meet their required goals, citizens took the state to court and won.

A proposed bill currently under discussion in the Vermont legislature aims to build on these examples.

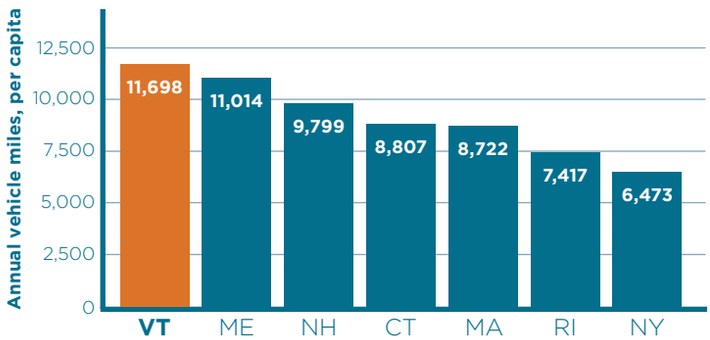
1. Vermont Agency of Natural Resources. 2020. Transportation and Climate Initiative. **2.** Efficiency Vermont. October 2019. Vermont Energy Burden Report.

What's behind the net increase in transportation emissions?

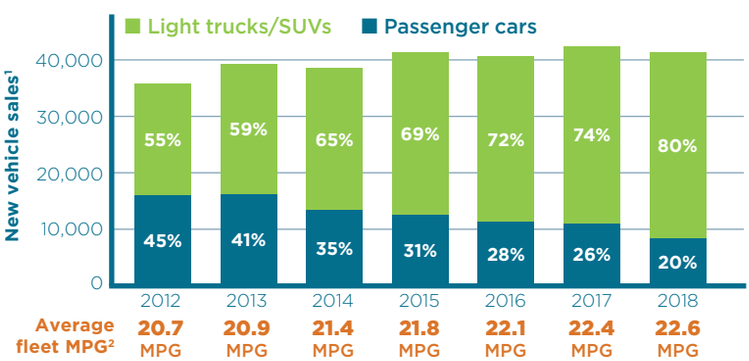
Vermont's mostly rural settlement pattern and our heavy reliance on fossil-fueled vehicles are at the root of our transportation energy use and emissions. The use of **on-road gasoline, primarily for passenger vehicles, accounts for 74% of total transportation emissions**, followed by on-road diesel at 12%.[3]

Several recent trends inform why transportation emissions are increasing. **The number of vehicle miles traveled per person has been on the rise since 2014, with Vermonters driving 11,888 miles per capita in 2017, up 190 miles from 2015, and more per capita than any other state in the region.**[4] Additionally, while vehicles have been getting more efficient overall, Vermonters have been buying bigger vehicles, limiting the benefit we could be getting from increased fuel efficiency standards. Last year 80% of new vehicles sold were SUVs or light trucks. Seven years ago it was 55%.[5] This aligns with global trends, where a doubling in market share for SUVs was the second-largest contributor to the increase in worldwide CO2 emissions since 2010.[6]

Vehicle miles traveled per capita, 2015



As cars get more efficient, we're buying bigger cars



Making our transportation more efficient

Reducing our energy use and emissions in transportation isn't just a question of driving more efficient fossil-fueled vehicles or switching to electric or other low-emissions vehicles. Walking, biking, taking a bus with high ridership, or carpooling are significantly more efficient than driving on your own (single occupancy vehicle trips).

Our Path to Paris outlines the need to reduce single occupancy commutes and increase transit ridership. However, a recent report shows that the percent of VT commuters who drive alone is on the rise, and transit ridership has only just started to increase after several years of decline.[7]

1. Drive Electric Vermont. 2019. **2.** Vermont Agency of Transportation/University of Vermont Transportation Research Center. November 2019. **3.** Vermont Agency of Natural Resources. 2019 Greenhouse Gas Emissions Inventory Brief (1990-2016). **4.** Vermont Agency of Transportation/University of Vermont Transportation Research Center. November 2019. **5.** Vermont Vehicle and Automotive Distributors Association (VADA). 2019. **6.** International Energy Agency. 2019. **7.** Vermont Agency of Transportation/University of Vermont Transportation Research Center. November 2019.

ACTION PROFILE: **Piloting Electric Buses**

In July, VT received a $3 million federal grant to purchase electric buses and charging stations to be used in the Upper Valley. The Vermont Agency of Transportation (VTrans) will implement the project in partnership with Green Mountain Power and Advance Transit, Inc. Meanwhile, the Department of Environmental Conservation is overseeing **a pilot to demonstrate the viability of electric buses as a reliable and cost-effective option for school districts and transit agencies.** The program is administered by the Vermont Energy Investment Corporation. Burlington Electric Department also helped Green Mountain Transit Authority (GMTA) purchase two new all-electric buses.

The benefits of a more efficient transportation system

One key component of a more efficient transportation system is more efficient land use patterns, with development centered around transit hubs and housing within walking distance of employers and schools. This reduces greenhouse gas emissions by encouraging walking, biking, and reducing vehicle miles traveled by community members. **Vermont households that live within half a mile of a downtown drive 30% less than the median household in the state.**[1]

This shift has a significant public health benefit as well. If Vermont implemented the walk/bike/transit goals from the 2016 Comprehensive Energy Plan (which focus on travel-related behavioral changes, and are more modest than EAN's Path to Paris goals), the VT Department of Health estimates that more than 2,000 early deaths could be prevented and over $1B in health costs could be saved.[2]

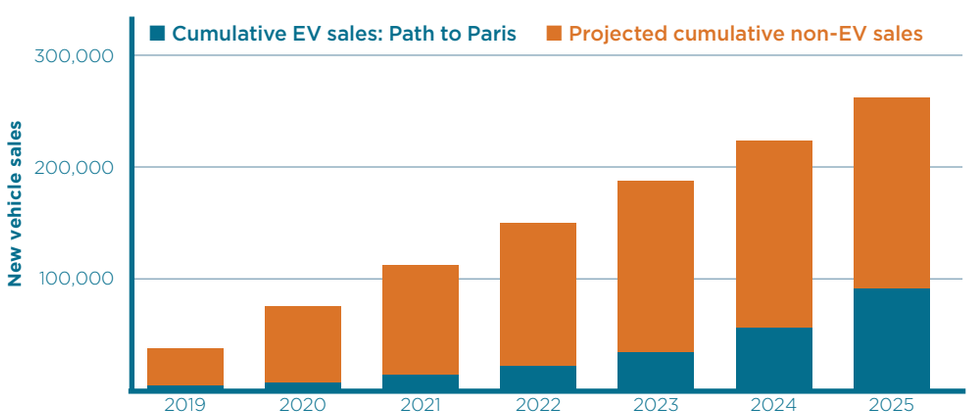
Accelerating electric vehicle adoption

Changes to our land use patterns and transportation system take time. In the meantime, switching to low and zero-emissions vehicles remains a key component of reducing energy and emissions from transportation.

While electric vehicle adoption has been growing in Vermont, in order to reach the Path to Paris goal of 90,000 additional vehicles by 2025, adoption would need to grow about 65% each year, faster than it has to date.

The chart at right compares the cumulative growth of electric vehicles under the Paris model between now and 2025, and projected cumulative new vehicle sales in the same time frame (based on the current annual average[4]). An estimated 240,000 new vehicles will be sold in VT between 2020-2025, of which EVs would have to make up a little more than a third.

EVs need to make up at least a third of new vehicles sold through 2025



1. Vermont Department of Housing and Community Development. Data from Federal Highway Administration. **2.** Vermont Department of Health. 2019. **3.** Historic data from Drive Electric Vermont (VEIC). Modeled data assumes 50% All-Electric Vehicles (AEVs) and 50% Plug-In Hybrid Electric Vehicles (PHEVs) in 2025. **4.** Extrapolated from Auto Alliance Vermont State Facts.

ACTION PROFILE: Transit-Oriented, Affordable, Efficient Housing

The city of Montpelier developed a project that features a transit center on the ground floor, serving as a hub for local and regional bus service, and 30 units of affordable housing above. The building is also next to a newly completed section of a regional bike path. **In addition to providing housing within walking distance of public transit and downtown businesses and improving the experience of using public transit in the state's capitol, the project is "nearly net zero."** A solar array on the roof produces enough electricity to offset energy use in the transit center and apartments. Heating and cooling in the highly efficient building is provided by air source heat pumps.

POLICY CASE STUDY: **Vehicle Electrification in Norway**

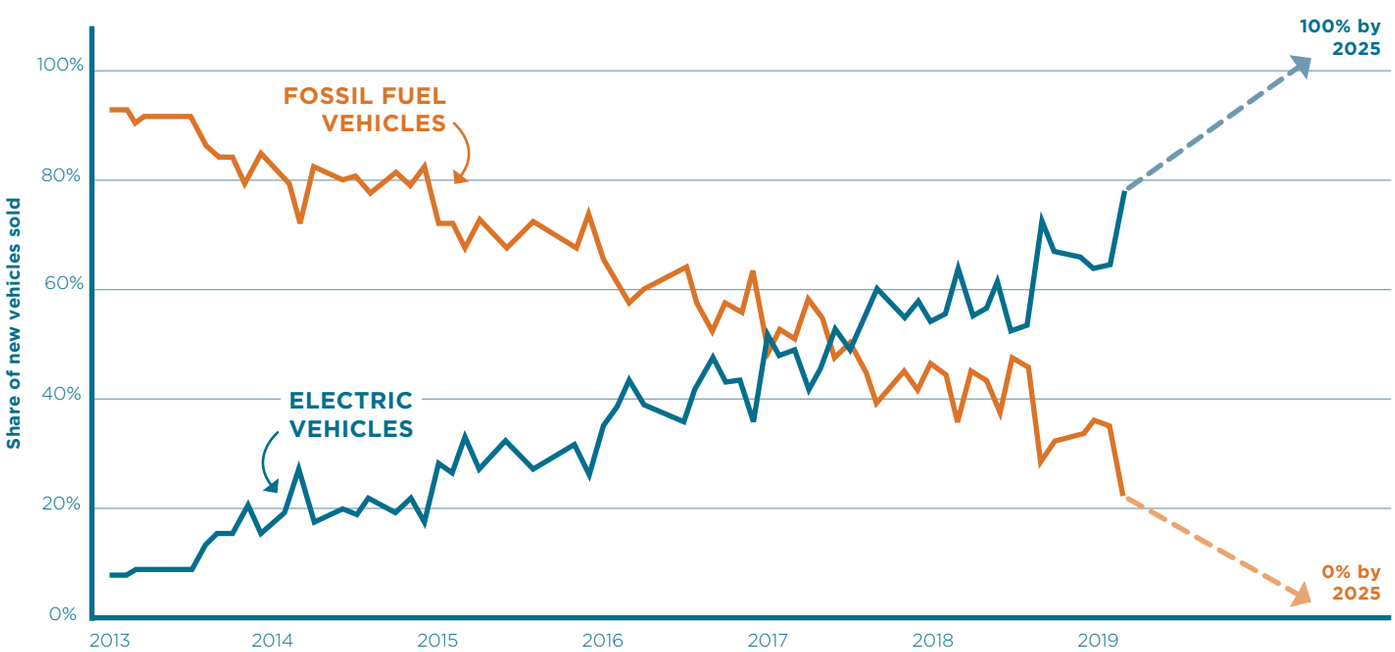
Safety, comfort, and reliability in the coldest days of winter are three of the requirements that Vermonters have for their vehicles. Norway, a country whose winters rival those in Vermont, has addressed these challenges while dramatically reducing transportation emissions.

What is Norway's path to low-emissions transportation? **The country set ambitious goals for EV adoption, including a requirement that all new vehicles sold after 2025 be zero emissions, and then backed up those goals with a comprehensive slate of policies to get there,** including:

- **Feebate/Tax Exemption:** no sales tax for no emissions vehicles, progressively higher taxes for higher emissions vehicles
- **Incentives for lower-income drivers** through scrap and replace
- **Cheaper operating costs:** lower power costs for EV charging, expanded public charging, free EV parking and charging
- **Rapid increase of total public charging stations** (now over 100,000 for a population of 5.3 million)
- **Electric public transportation** (including buses and ferries)
- **Sustainable funding** through polluter pays principle (sales tax on fossil fuel vehicles, carbon fee)[1]

As a result of this comprehensive package of incentives and policies, people are choosing to drive lower emission vehicles. Between 2014 and 2018, average CO2 emissions for the new passenger car fleet declined from 110 g/km (0.39 lb/mi) to 71 g/km (0.25 lb/mi), while the annual number of zero-emission passenger vehicle registrations increased from 18,094 to 46,143.[2]

EVs now the majority of new vehicles sold in Norway[3]



1. EAN Energy Futures Initiative. 2019. Transportation Electrification in Vermont. **2.** Norway Road Traffic Information Council. 2019. **3.** Norwegian Road Federation. 2019 (Reuters Graphics).

ACTION PROFILE: **Electric Car Test Drives**

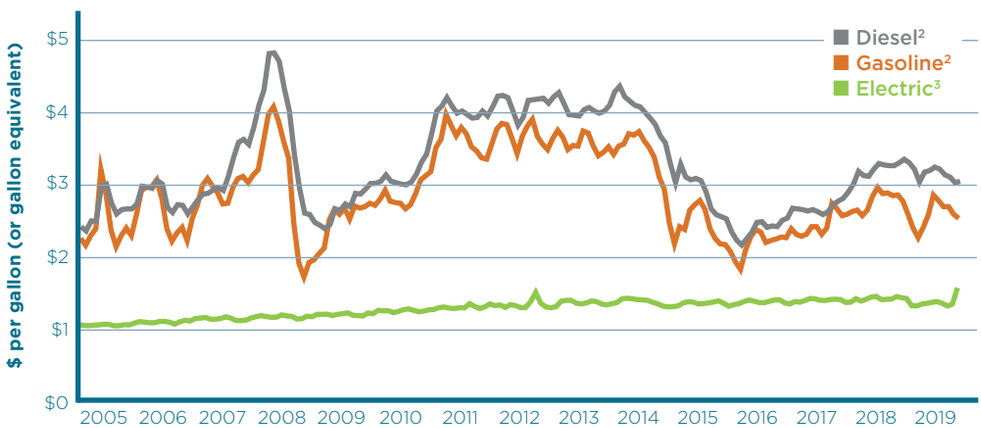
In 2019, Drive Electric Vermont worked with partners to organize events across the state to help Vermonters try out plug-in electric vehicles and learn about available incentives to reduce their upfront and ongoing costs. **Approximately 3,500 Vermonters engaged with auto dealer representatives and local electric vehicle owners who spoke to their experience operating them across Vermont in all types of driving conditions.** They also discussed advantages of electric cars over fossil-fuel-powered options, including cleaner air and thousands of dollars in potential savings on fuel and maintenance. Electric bicycles, mowers, buses, and solar-powered charging options were also featured at these events as additional options to increase efficiency and save money.

Economic benefits of going electric

In addition to the public health benefits and cost savings of a more efficient transportation sector, shifting from fossil fuel to electricity as our primary energy source for transportation will benefit both consumers and the Vermont economy. **In 2018, Vermont spent over $1.1 billion combined on gasoline (approx. $900 million) and diesel (approx. $200 million). 79% of those dollars drained out of the Vermont economy.[1]**

As the chart to the right illustrates, drivers of gasoline and diesel passenger vehicles are subject to large price swings from month to month and year to year. Electric vehicle charging costs are lower and much more stable. If a driver can utilize one of the off-peak charging programs provided by some electric utilities, the gallon equivalent charge could decrease even further; for example, the Burlington Electric Department offers an EV rate that costs just $0.63/gallon equivalent.

Gas and diesel vehicles are more expensive to drive than EVs



Gas vs. EV cost comparison over 150,000 miles[4]

	GAS VEHICLE	ELECTRIC VEHICLE
Fuel	$17,585	$9,164
Oil Changes & Filter Replacement	$900	None
Tire Changes	$600	$600
Engine Air Filter Replacements	$207	None
Cabin Air Filter Replacements	$273	$273
Spark Plug Replacements	$439	None
Coolant Flush and Replacement	$110	$110

Comparing operating costs, including cost per mile and maintenance costs, gas vehicle drivers spend nearly $10,000 more on operations and maintenance over the course of 150,000 miles.

1. Vermont Agency of Commerce and Community Development. 2020. **2.** Fuel prices (gasoline and diesel) from the Vermont Agency of Transportation (VTrans) and Drive Electric Vermont. **3.** Electric charging costs (gallon equivalent) calculated by Drive Electric VT, based on EIA data on average Vermont residential electric rates and the average efficiency of light-duty electric and gasoline vehicles. **4.** American Automobile Association. 2018. Your Driving Costs. **5.** California Air Resources Board. 2020. https://ww2.arb.ca.gov/resources/fact-sheets/small-engines-california.

ACTION PROFILE: Electric Lawn Mower Incentives

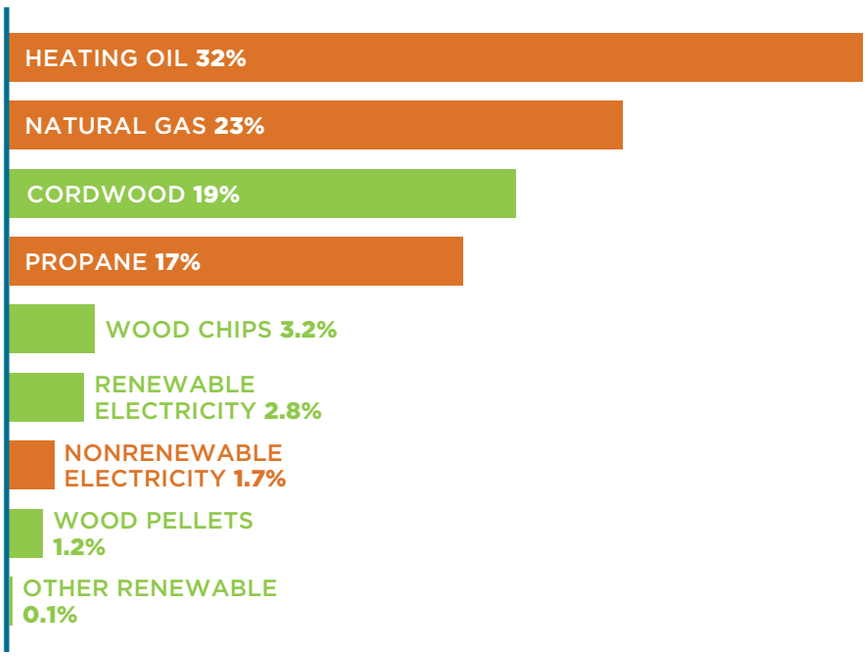
Vehicles and home heating systems aren't the only fossil-fuel powered equipment in our rural state. Emissions from fossil-fuel powered lawnmowers are significant; running a lawnmower for an hour emits the same amount as driving a car for 300 miles (or driving 6 to 8 cars for an hour).[5] **Since 2019, multiple VT utilities have created electric lawn mower incentives.** The incentives are one strategy in response to Vermont's Tier III Renewable Energy Standard that requires utilities to offset a certain percentage of the emissions associated with the production and transmission of the electricity they sell. Green Mountain Power, Burlington Electric Department, Vermont Electric Co-Op, and Washington Electric Co-op have all created incentives for commercial and residential mowers. Based on data from BED, VEC, and WEC more than 150 residential mower incentives have been issued.

It's time to change the way we heat our homes and buildings

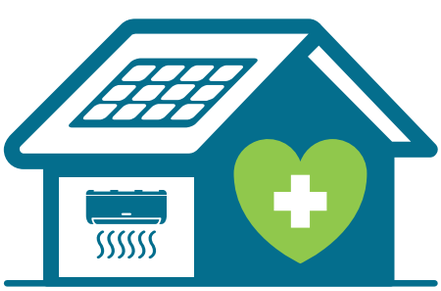
Thermal energy now makes up 45% of Vermont's energy use, more than any other sector. This is part of a global trend, with almost one fifth of the growth in global energy use in 2018 due to hotter summers driving demand for cooling and cold snaps leading to higher heating needs.[1]

More than 70% of Vermont's thermal energy use is fossil fuel-based. The good news is that, **no matter where you live Vermont and no matter what type of building you're trying to heat, there is a renewable, efficient heating technology that can work, right now.** And most of these technologies are significantly lower-cost over time than fossil-fuel heating systems.

Vermont heating energy sources[2]



Given this, and the 15-30 year life span of most home-heating systems, we need to stop installing fossil fueled heating equipment in our state if we are to have a chance of meeting our 90% by 2050 goal. Making this change will also help protect consumers from high and volatile prices and avoid being stuck with stranded assets.



Healthy indoor environments

In addition to energy savings, advanced, efficient, and renewable technologies can improve indoor air quality and create greater indoor comfort, leading to better respiratory health and overall well-being.[3] The Vermont Department of Health also reports strong evidence for the positive impact of home weatherization on general health, productivity, social health, and upper respiratory health. They estimate that, over the course of 10 years, the health and fuel-savings from a weatherization project are nearly three times greater than the initial investment.[4]

1. International Energy Agency. 2019. **2.** Fossil Fuels: Energy Information Administration (2019); Renewable Fuels: Biomass Energy Research Center (2017). **3.** Vermont Department of Health. 2017. Climate Change + Your Health. **4.** Vermont Department of Health. 2018. Weatherization + Health.

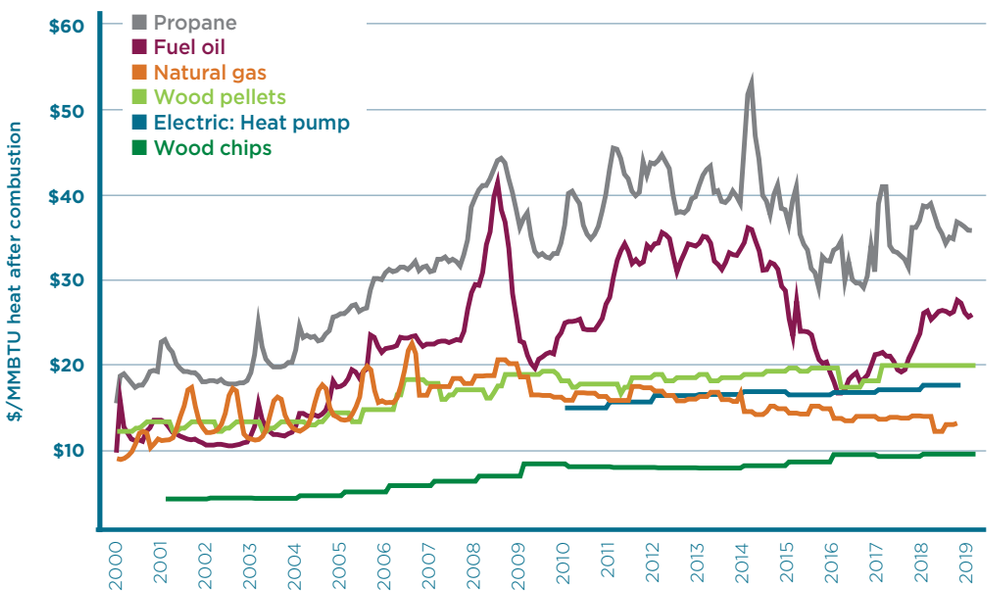
ACTION PROFILE: Transforming Building Energy

Zero Energy Now, a project of the Building Performance Professionals Association (BPPA) **combines weatherization, super-efficient heating, renewable energy, and financing matched to energy savings to transform VT buildings.** BPPA piloted this whole-systems approach in 2016-17 with 24 homes that attained an average 62% reduction in electric grid and fossil fuel use – more than 3 times what typical efficiency programs achieve. Ten of the 24 homes had a 90% or greater fossil fuel reduction. BPPA is working to develop the funding and support necessary to get a large-scale ZEN program up and running.

The way we heat our homes is a strain on Vermonters and a drain on the economy

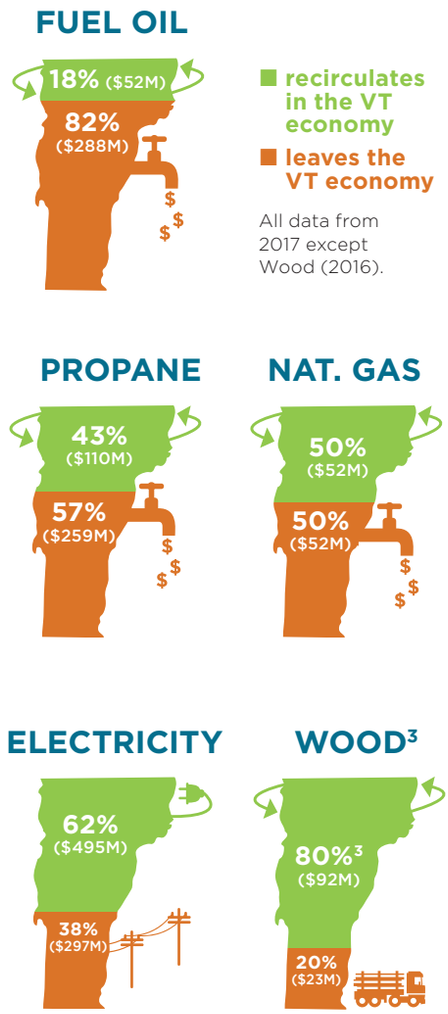
Prices for fossil fuels like propane and fuel oil have historically been the highest and most volatile. Weatherizing your home or business can cut these costs by reducing energy use. Even better, switching to renewable heating options offers lower and more stable fuel prices.

Renewable heating options are lower cost and more stable than fossil fuels[1]



In 2017, Vermont spent over $650 million on fossil heating fuels. Of that, 67% left the Vermont economy entirely. In contrast, all of the efficient and renewable alternatives keep a much higher share of our energy dollars recirculating in Vermont, helping employ our neighbors, and improving our local economy.

How much money stays vs. leaves the state for different heating options?[2]



1. Biomass Energy Research Center. 2019. **2.** Vermont Agency of Commerce and Community Development. 2020. **3.** Assumes use or purchase of cord wood, wood chips, or wood pellets from Vermont.

ACTION PROFILE: **VGS Weatherization**

VGS (formerly Vermont Gas Systems) has outlined a comprehensive plan to double its energy efficiency program savings by 2025 by investing $20 million upfront in-home weatherization, as well as commercial & industrial energy improvements. On average, customers save between 15-20% on heating bills after a weatherization project has been completed and approximately $200/year. **This initiative will include weatherizing approximately 3,350 homes from 2021–2025, or a 200% increase compared to the previous five years.** These efforts help advance the State's goal of dramatically increasing weatherization for low-to-moderate income Vermonters.

POLICY CASE STUDY: **Renewable Thermal Heat in Upper Austria**

The state of Upper Austria—with half the total land area, half the forested area, and double the population of Vermont—is meeting 47% of total heating demand from renewable sources, mostly from clean, automated wood heat systems, while managing its forests for long-term sustainability. **Since 1985, the state has provided consistent and integrated policy support support for renewables in the thermal energy sector, utilizing a combination of "carrots, sticks, and tambourines":**[1]

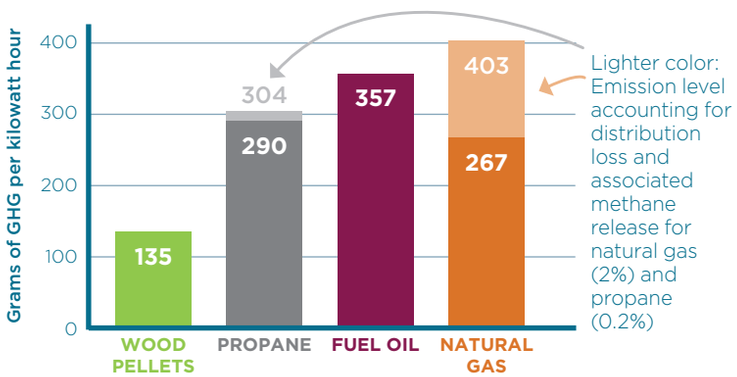
- Carrots are financial measures, and include incentives and grant programs and regional R&D and pilot projects.
- Sticks are legal measures, and include emissions and efficiency standards and renewable heating mandates.
- Tambourines are outreach and information measures, and include energy advice, training and education programs, and promotional campaigns to increase adoption of advanced wood heating.

In addition to significantly reducing greenhouse gas emissions from the heating sector, these policies have supported the development of a network of over 160 companies and institutions that employ more than 8,880 people and generate annual revenues of more than 1.9 billion Euro ($2.5 billion).[2] The network includes farmers and foresters who manufacture and distribute wood chips and pellets, cooperatives that build and operate district heating systems, and entrepreneurs who have become global leaders in the design and manufacture of automated wood boilers.

Wood heat and Vermont forests

The complexity and magnitude of climate change is raising legitimate questions about the role of forests and forest products. Keeping forests as forests is paramount, not only for Vermont's culture and economy, but also to help absorb and sequester carbon. Additionally, Vermont has long viewed the use of locally harvested and processed wood fuel as a key part of both managing and sustaining healthy forests while meeting our renewable energy goals, particularly in the thermal energy sector. While using wood for electricity generation is only about 20%–25% efficient, using wood for heating is often 75%–80% efficient.[3] A 2015 report by the Spatial Informatics Group – Natural Assets Laboratory (SIG-NAL) found that using wood pellets harvested and produced in the northeast immediately cuts greenhouse gas emissions by more than half compared to heating with fossil fuels (a 54% reduction when replacing heating oil; 59% when replacing natural gas in the first year alone, with increasing reductions in future years[4]).

Wood pellets from Northeast cut GHG emissions vs. fossil fuel heating[4]



Central to this benefit is the use of highly efficient, clean burning/low emitting technology, as is actively improving long-term forest health through sustainable forestry practices. Vermont has identified a target of meeting 35% of our thermal energy needs from wood by 2030.

1. Austria, State of Upper Austria. 2018. OÖ Energiesparverband. **2.** Austria, State of Upper Austria. 2017. OÖ Energiesparverband. Biomass heating in Upper Austria: Green energy, green jobs. **3.** Biomass Energy Research Center. 2017. **4.** Buchholz, Thomas, John S. Gunn, and David S. Saah. September 2017.

ACTION PROFILE: **Energy Efficiency and Renewables at Vermont Glove**

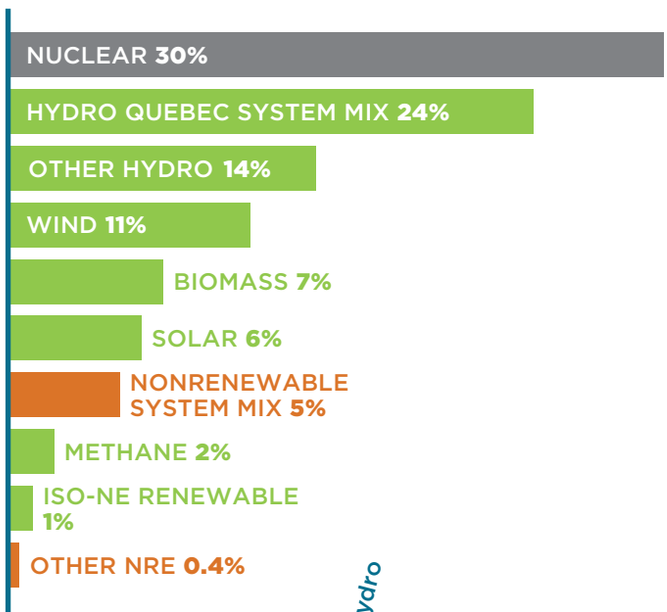
Vermont Glove is a 100-year-old business based out of Randolph that manufactures work gloves for everyday consumers and trade professions, serving electric utilities around the country, including at Burlington Electric Department and Green Mountain Power. Now those gloves are made in a net-zero factory. **Vermont Glove worked with Efficiency Vermont on projects including transitioning from a coal boiler to a renewable wood pellet boiler, installed by SunWood Biomass.** They reduced the air leakage of the 100-year-old building by more than half through air sealing and densely packed cellulose insulation, saving $11,500 on annual heating costs. They also partnered with Catamount Solar on the installation of a 12.8 kw solar array on the roof, using about 1/6th of the energy produced.

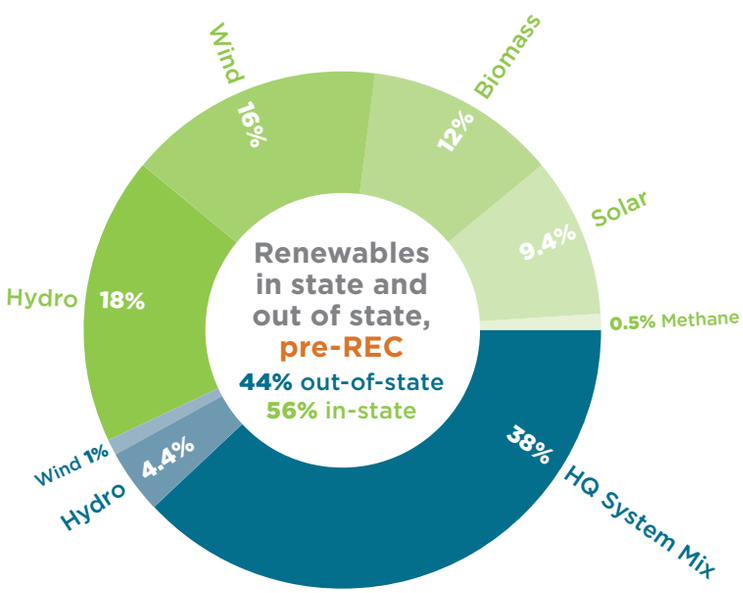
Understanding where Vermont's electricity comes from

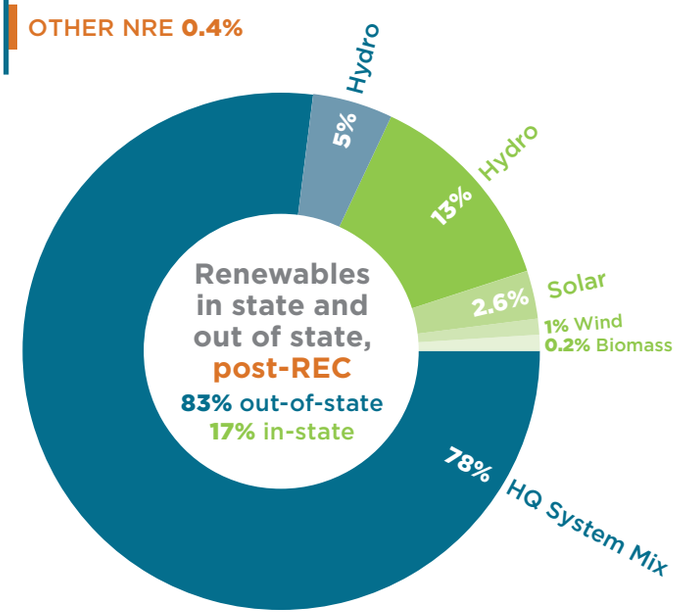
There are several ways to measure electricity generation in Vermont. While we generate energy from a variety of renewable sources in Vermont, the high-value Renewable Energy Credits (RECs) from many of those resources are sold. In the chart at right, you can see the pre-REC generation and purchases in Vermont's 2018 electric mix. In 2018, Vermont utilities sold high-value solar, wind, and biomass RECs, and bought lower cost hydro RECs to fulfill the first tier of VT's Renewable Energy Standard (RES).

Going a step further, we can also look at Vermont's renewable energy comparing in-state generation to out-of-state generation, both pre- and post-REC accounting (see charts below[2]). This shows that the vast majority of renewable energy generated in-state is not counted as part of our renewable generation under the RES.

VT electricity generation and purchases 2018, pre-REC







1. Vermont Department of Public Service. January 15, 2020. 2020 Annual Report on the Renewable Energy Standard. Note: Post-REC purchases and sales could include attributes from previous years that were banked. **2.** EAN analysis of in-state and out-of-state pre-REC and post-REC.

ACTION PROFILE: Partnering to promote renewables in thermal & electricity

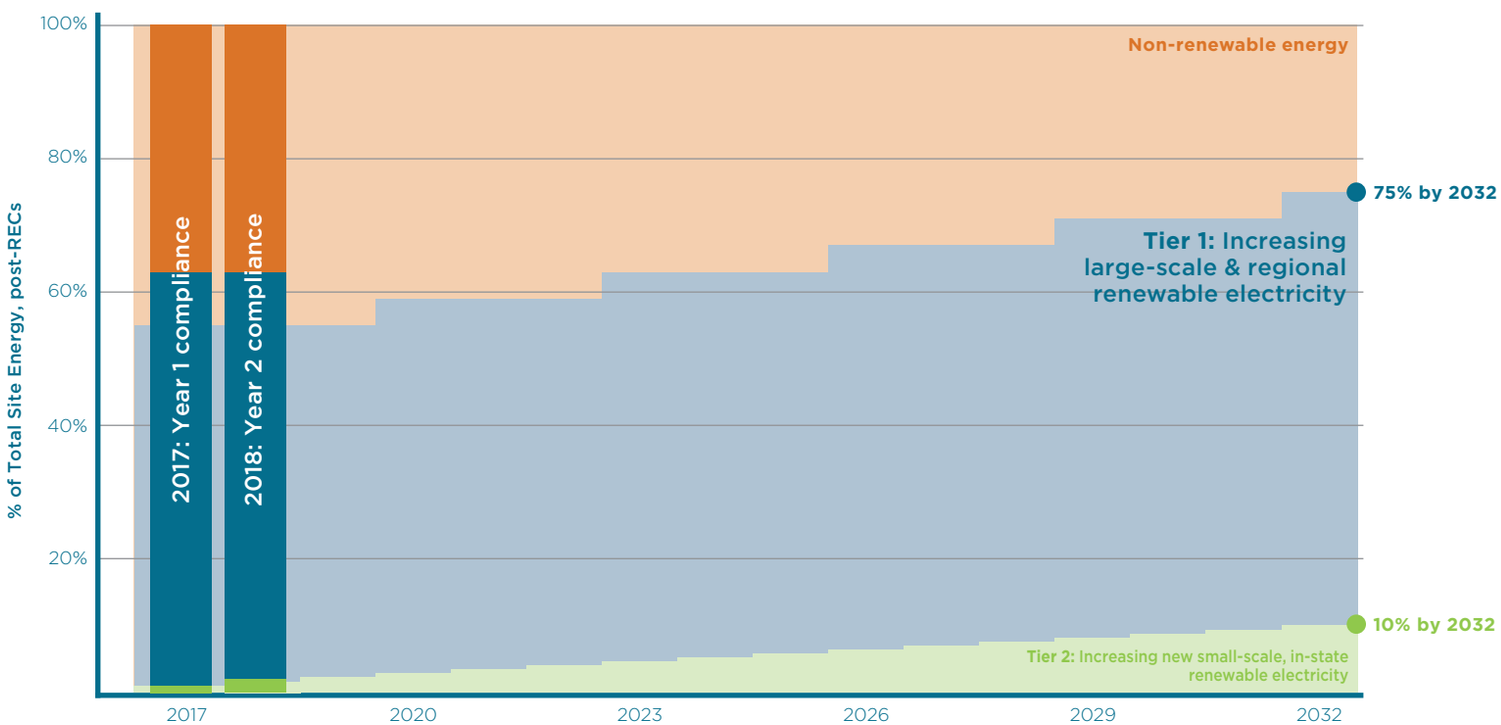
The Energy Co-op of Vermont and Catamount Solar, two companies organized as co-ops, developed a partnership to promote solar installations. Energy Co-op is a fuel dealer that helps members reduce their energy costs by using less fossil fuel and transitioning to renewable fuels where it makes sense. Their members were interested in learning more about solar options, but they didn't have the expertise in-house to offer installation. **They teamed up with Catamount Solar to provide solar services, co-op to co-op.** Catamount designs and installs residential, commercial and off grid solar systems, along with grid-tied battery back up systems. The agreement includes a range of co-marketing programs and a discount of up to $1,000 on new residential solar installations for Energy Co-op members.

Vermont Renewable Energy Standard: A lever for change

2017 was the first year of implementation of Vermont's Renewable Energy Standard (RES), Tiers 1 and 2 of which require utilities to increase their share of renewable electricity sources over time.[1] Looking at data from 2018 shows that utilities have exceeded initial Tier 1 requirements, achieving 62% total renewable electricity for Vermont. Nearly 100% of the Tier 1 RECs came from hydropower and the Hydro-Quebec System Mix. Three Vermont utilities — Burlington Electric Department, Washington Electric Coop, and Swanton Electric — are 100% renewable pre- and post-REC. All other utilities met their 2018 Tier 2 requirement of 1.6% new, small scale, in-state renewable electric generation.

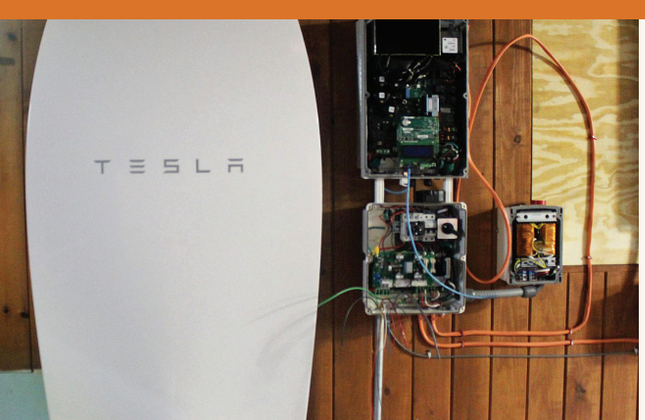
Tier 3 of the RES requires utilities to acquire fossil fuel savings from energy transformation projects that reduce fossil fuel use for their customers. In response, VT utilities have created programs that incentivize renewable technologies in the transportation and thermal sectors (e.g. electric vehicles, cold climate heat pumps). This aspect of the RES is one way that Vermont has started to promote a total energy transition through policy.

Vermont Renewable Energy Standard targets and compliance



1. Vermont Department of Public Service. 2020. Annual Report on the Renewable Energy Standard. **2.** The Renewable Energy Standard requires that utilities meet 10% of their energy generation from small-scale, in-state renewables by 2032, which means they must increase generation from these sources at 0.6% annually.

ACTION PROFILE: Distributed Energy Resources and 'Bring Your Own Device'



Green Mountain Power pioneered two home battery storage pilot programs — one for utility-owned batteries and one for customer-owned batteries, a "bring your own device" pilot developed in partnership with Renewable Energy Vermont. Customers get the resiliency of seamless backup power during outages, and also share access to the stored energy in the batteries during peak demand times on the grid. **This reduces costs for all GMP customers while also reducing carbon emissions.** Peak demand times are when power can be dirtiest and most expensive. The batteries can be recharged with solar, or with GMP's 90% carbon free/60% renewable energy from the grid.

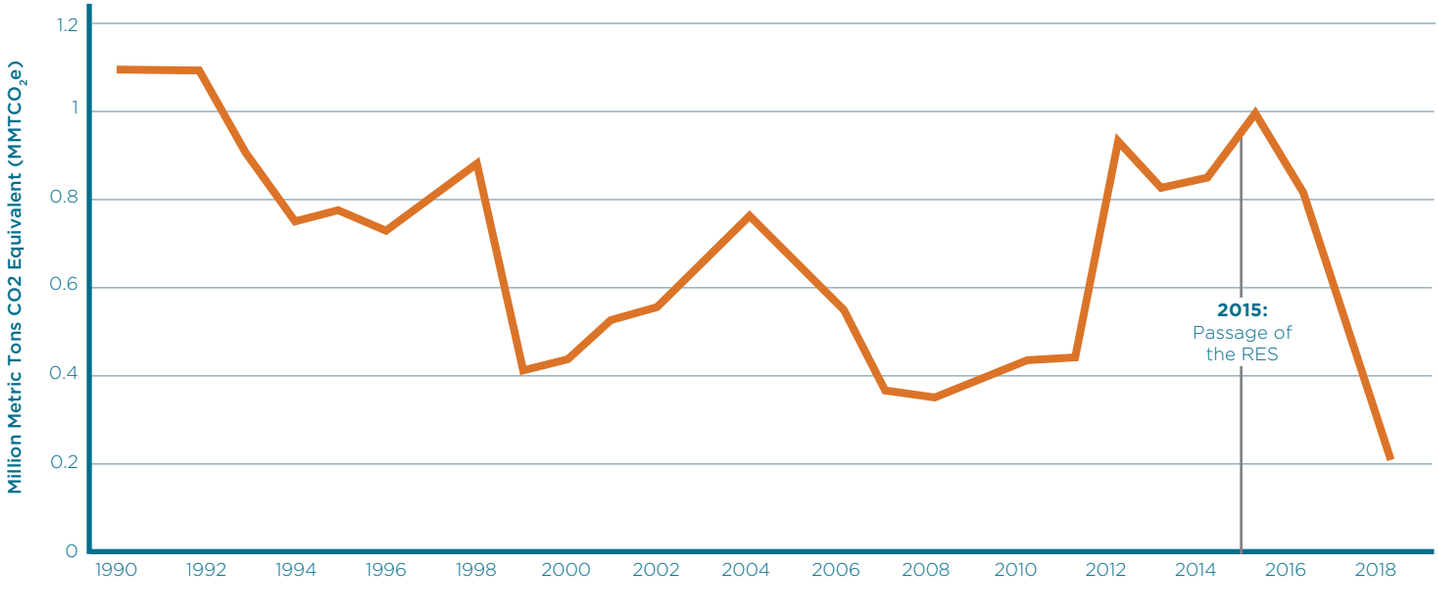
Vermont's electricity is getting increasingly renewable…and much cleaner

Vermont's electricity mix in 2018 was lower-emitting than it has ever been, following a trend that began in 2016 and accelerated in response to several factors, including the implementation of the Renewable Energy Standard in 2017, changes in energy purchasing by Vermont utilities, and a cleaner state mix that relies less and less on the regional electricity mix.

Nearly all of the GHG emissions from Vermont's electricity consumption are attributable to that portion of electricity that we source from the regional system mix through ISO-NE. The renewability of that ISO-NE system mix increased from 4% in 2010 to 16% in 2017. More importantly, between 2017 and 2018, the ISO-NE system mix portion of Vermont's electricity portfolio (primarily natural gas) decreased from 30% to 6%. The majority of this was replaced with nuclear.

The net result of these trends was a drop of more than 75% — from 0.81 to 0.19 MM tons — in Vermont's electricity sector emissions between 2016 and 2018. **Vermont now has the least carbon intensive electricity sector in the U.S., both overall and per capita.**

GHG emissions from the electricity sector, consumption based[1]



Beneficial electrification of transportation and thermal will mean more dollars for Vermonters

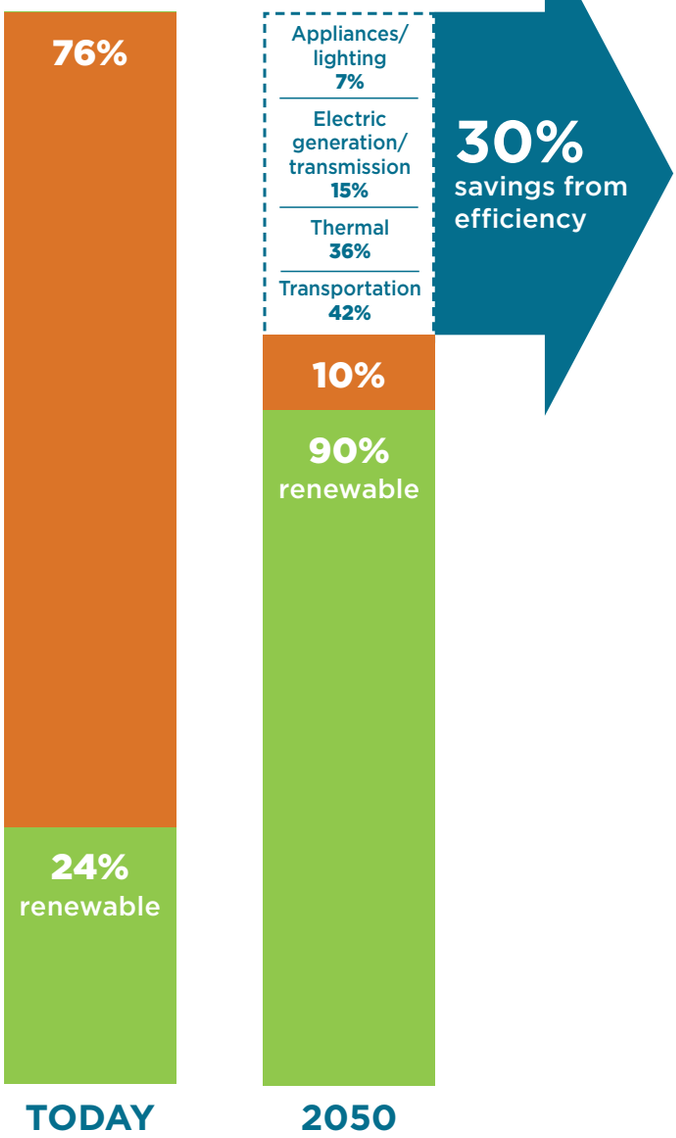
Because of this clean electricity mix, and the second lowest rates in New England, we now have the opportunity to achieve both emissions reduction and economic savings by electrifying our transportation and thermal sectors.

Approximately 62 cents of every dollar we spend on electricity stays and circulates in state, compared to 25 cents of every dollar spent on fossil fuels. The majority of dollars Vermonters pay to their utilities supports local jobs, including line maintenance, tree trimming, customer service, and programs that further reduce emissions from our electricity.[2]

1. Vermont Agency of Natural Resources. 2019 Greenhouse Gas Emissions Inventory Brief (1990-2016). **2.** Vermont Agency of Commerce and Community Development. 2020.

We can't get there without efficiency

What will it take to reach 90% by 2050?



Reaching our state energy goals is not just a question of switching to renewable sources, it also requires reducing our total energy use 30% by 2050 through greater efficiency. However, these goals are closely related. Energy efficiency is most often associated with building weatherization or more efficient lighting. But we also achieve (often far larger) efficiency gains when we switch from fossil fuel combustion systems to more technologically advanced systems that use much less energy, such as electric vehicles and heat pumps.[1]

Redefining efficiency

The definition of efficiency is not limited to electricity; becoming more efficient doesn't mean that electric use will keep going down. In fact, as we strategically electrify more of our transportation and heating, electricity use will go up. But this increase in electrification will significantly decrease total energy use and drive down overall emissions statewide.

In recognition of this, a conversation is underway to examine the most effective mechanisms to deliver and fund efficiency services in Vermont. Efficiency programs funded by a surcharge on electric bills have prioritized and measured their impact by reducing electric use, which historically was an expensive and polluting source of energy. Now, with Vermont's electric mix becoming increasingly renewable, there is an opportunity to consider the context and parameters of different types of energy efficiency, with an eye toward cost-effective greenhouse gas emissions reductions across the electricity, transportation, and thermal sectors.

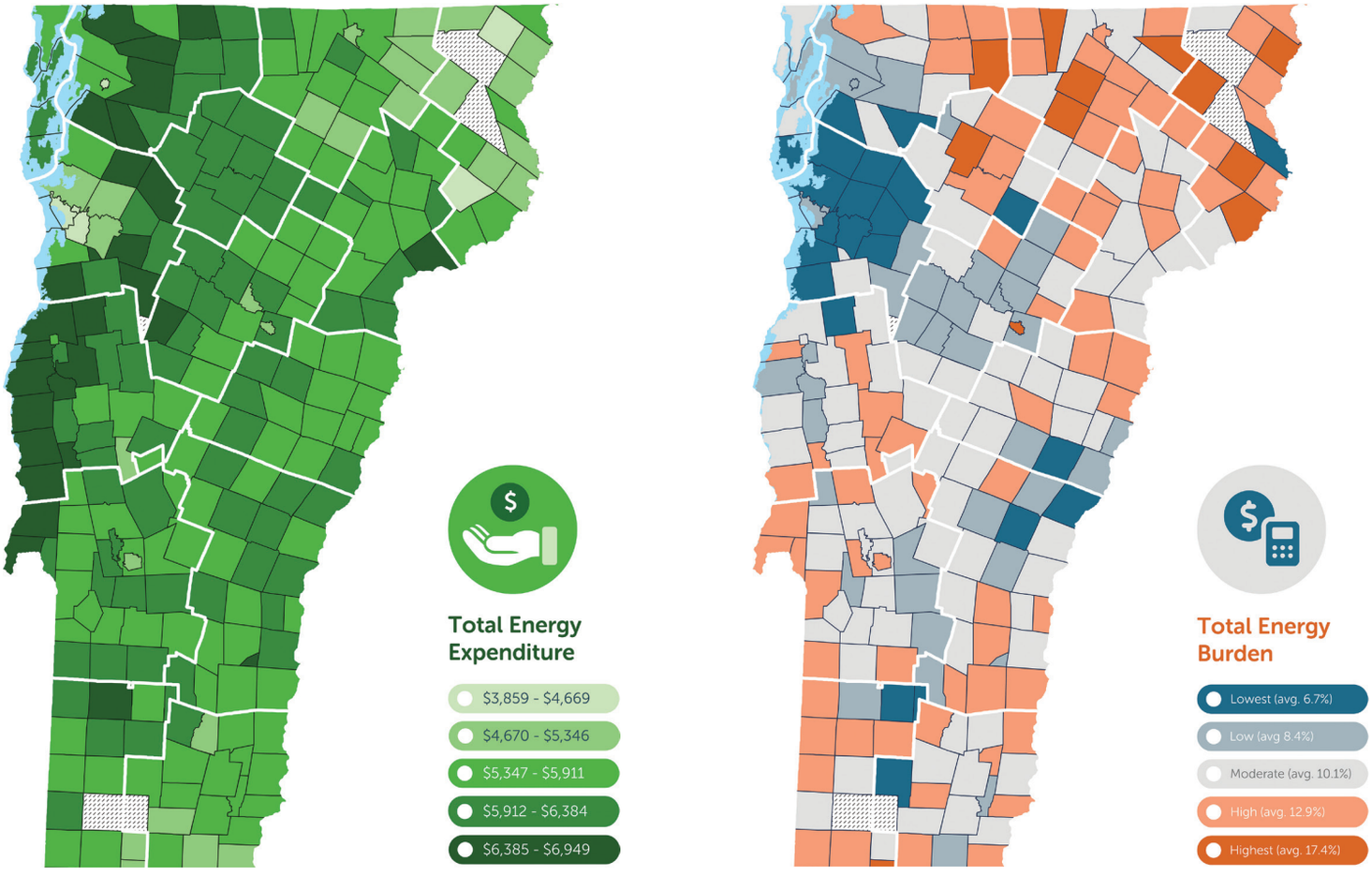
1. EAN Pathways Analysis.

ACTION PROFILE: Ramping Up Weatherization Where It's Needed Most

In 2019, Efficiency Vermont (EVT) ramped up weatherization for moderate-income families who are not eligible for free weatherization services through the Weatherization Assistance Program. EVT, Burlington Electric Department, and VGS, the state's efficiency utilities, partnered to increase the value of weatherization incentives for income-eligible households. EVT also partnered with Vermont Technical College to offer free trainings to grow the qualified weatherization workforce. **Efficiency Vermont is on track to complete 40% more weatherization projects in 2019 than it did in 2018, and half of those projects will serve moderate-income customers.**

Energy inequity

Energy burden is the percent of household income that Vermonters spend on energy. In 2019, Efficiency Vermont produced a report looking at energy burden around the state.[1] What they found is that average energy burden varies by town from 6% to 20%, and that the towns with the highest energy burdens are not spending more on energy, they have lower median incomes. Efficiency Vermont is using this information to reach high energy burden households, so that their energy-savings services are going where they are needed most. Vermont's total energy transformation needs to address energy inequity, including through low-income weatherization, increased incentives for efficient and renewable technologies, and access to affordable, efficient rural transit.



Source: Efficiency Vermont

Climate inequity

The climate crisis is and will continue to disproportionately impact low-income and other vulnerable populations. Extreme heat, flooding, and other extreme weather events can be especially harmful to the homeless and those with health vulnerabilities due to age and chronic or pre-existing medical conditions. According to the VT Dept of Health, "Even people in good current health but lacking economic, social, or other political resources may have less ability than others to reduce their risks, prevent impacts from occurring, and recover from impacts when they occur."[2]

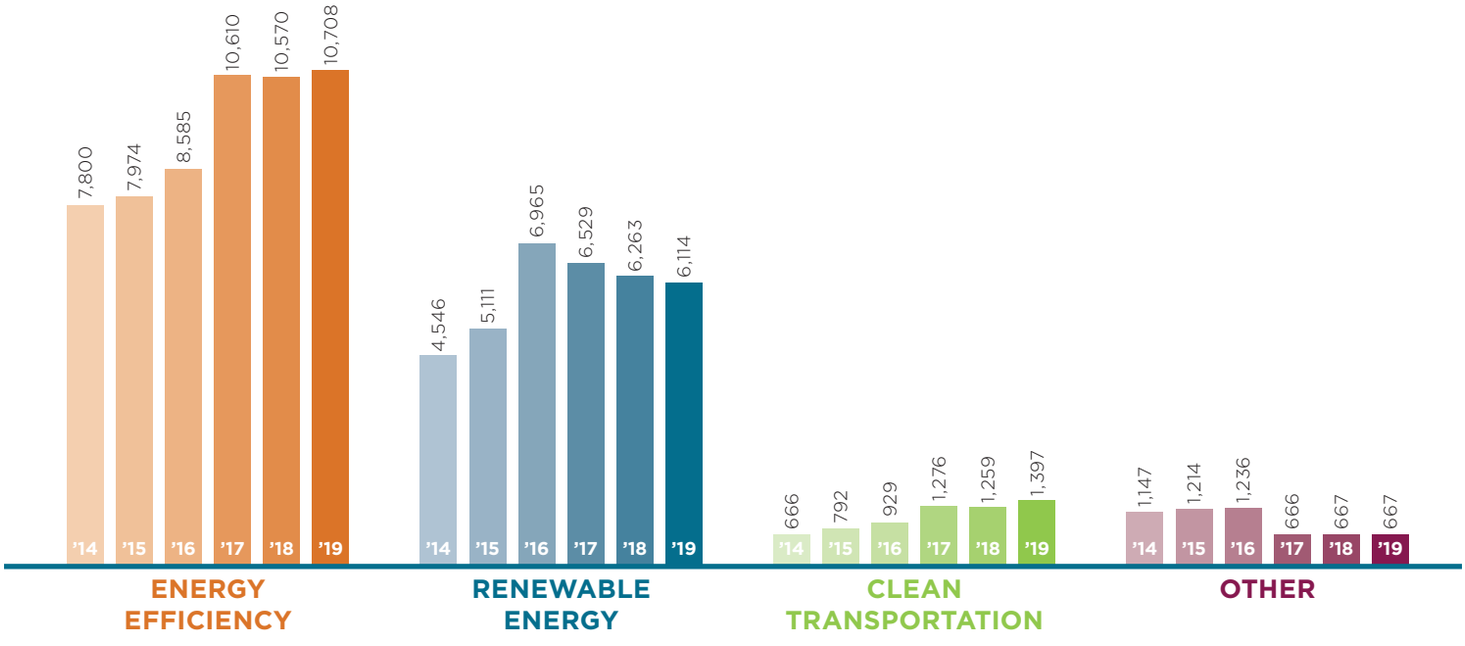
1. Efficiency Vermont. October 2019. Vermont Energy Burden Report. **2.** Vermont Department of Health. 2017. Climate Change + Your Health.

Clean energy jobs and the VT economy

After a decline in 2018, clean energy jobs are once again on the rise in Vermont, although they have yet to bounce back to 2017 peak levels. Vermont continues to have the highest clean energy employment per capita in the nation at 6% of overall jobs.

The energy efficiency sector saw the most clean energy job growth over 2018, and continues to make up the majority of VT's clean energy jobs. There was also growth in the clean transportation sector. The number of renewable energy sector jobs declined for the third year in a row, with most of the loss coming from solar jobs.[1]

Vermont clean employment growth by technology, 2014–2019[2]



Vermont median hourly wages for clean energy jobs[2]

	RENEWABLE ENERGY			ENERGY EFFICIENCY		
	Entry	Mid	High	Entry	Mid	High
Electricians	$13.57	$19.43	$28.89	$18.91	$25.47	$32.95
HVAC workers	$13.10	$20.77	$32.66	$18.43	$25.15	$35.05
Installation, maintenance, and repair technicians	$13.10	$20.77	$32.66	$14.84	$20.72	$30.23
Sales representatives	$17.60	$28.71	$56.74	$30.55	$39.57	$68.70
Engineers	$24.99	$37.21	$56.61	$23.78	$39.38	$57.98

Clean energy jobs continue to be good-paying jobs, with wages well above the state median hourly wage of $19.10 for all occupations. However, for the third year in a row, clean energy employers are reporting hiring difficulties, especially outside of the Burlington area.

The 2019 Clean Energy Industry Report identifies young Vermonters with a high-school education or less as a promising target for training and apprenticeship programs in clean energy, given their comparatively high unemployment rate and the good wages in the sector.

1. US Bureau of Labor Statistics. May 2018. **2.** Vermont Department of Public Service, Clean Energy Development Fund. May 2019.

VT statutory energy & emissions targets, 2018 status

OVERALL STATUS

Undetermined

Already met or on track to meet

Not met or not on track to meet

CHANGE FROM LAST YEAR

Year-to-year progress flat

Increasing rate of year-to-year progress

Decreasing rate of year-to-year progress

	GOAL OR STATUTE	TARGET	TARGET DATE	OVERALL STATUS	TREND
TOTAL ENERGY	**CEP (2016):** Meet 90% of the state's total energy needs through renewables — including thermal, transportation, and electric (Note: energy sourced in-state and out of state)[1].	90%	2050	24%	↑
	CEP (2016): Reduce total energy use (from 2010 levels) by over 30% by 2050 through efficiency and conservation, across thermal, transportation, and electric.	-30% 90 trillion BTU	2050	+1% 120 trillion BTU (2019)[2]	→
	10 V.S.A. 580(a) (2007): Produce 25% of all energy consumed within the state through the use of renewable energy sources, particularly from forests and farms (in-state).	25%	2025	13%	↑
	30 V.S.A. 8002 (2015): Tier 3 — Require 2% of utility sales (BTU equivalency) in 2017 to reduce fossil fuel consumption, rising to 12% in 2032. Projects must be new, in-state, and in service in 2015 or later.	2% 12%	2017 2032	2.6%[3]	→
	24 V.S.A. 4302(c)(7) (2016): Develop energy plans for regions and municipalities consistent with the CEP goals.	11 regions	2018 for RPCs Voluntary for towns	11 approved (regional) 38 approved (town)	↑
GHG EMISSIONS	**10 V.S.A. 578(a):** Reduce greenhouse gas emissions within the state and from outside the state's boundaries caused by the use of energy within the state by 50% of 1990 levels by 2028, and if practicable using reasonable efforts, by 75% of by 2050 (in-state and out- of-state).	50% 75%	2028 2050	+13% (2016)[5]	↑
	CEP (2016): Reduce greenhouse gas emissions by 40% below 1990 by 2030.	40%	2030	+13% (2016)[5]	↑
	Paris Agreement: Reduce GHG emissions by 26%-28% below 2005 levels.	26-28%	2025	-5% (2016)[5]	↑
TRANSPORTATION	**CEP (2016):** Reduce total transportation energy use by 20% from 2015 levels by 2025.	-20% 39.1 trillion BTU	2025	-1.6% 48.2 trillion BTU	→
	CEP (2016): Reduce transportation-emitted GHGs by 30% from 1990 levels by 2025.	-30% 2.37 MMTCO2e	2025	+28% 4.34 MMTCO2e (2016)	→
	CEP (2016): Hold vehicle miles traveled (VMT) per capita to 2011 levels.	11,390	2030	11,888 (2017)[6]	→
	CEP (2016): Reduce share of single- occupancy vehicle commute trips by 20% of 2011 levels (79.5%).	-20%	2030	+2.4%, 81.4% (2017)	N/A[2]
	CEP (2016): Double the share of bicycle and pedestrian commute trips from 7.8% to 15.6%.	15.6%	2030	6.8% (2017)	→
	CEP (2016): Triple the number of state park-and-ride spaces from 1,142 to 3,426.	3,426	2030	1,639 (2019)	↑
	CEP (2016): Increase public transit ridership by 110% to 8.7 million annual trips	8.7M	2030	4.74M (FY18)	→
	CEP (2016): Quadruple Vermont-based passenger rail trips from 2011 levels (91,942) to 400,000 trips annually.	400,000	2030	91,935 (FY18)	↓
	CEP (2016): Double rail freight tonnage in the state from 2011 levels (6.6 million tons).	13.2 million tons	2030	7.3 million tons (2014)	N/A[2]
	CEP (2016): Increase % of the vehicle fleet that are Plug-In Electric Vehicles to 10% by 2025.	10%	2025	0.71% (2019)	↑
	CEP (2016): Increase number of medium and heavy-duty vehicles powered by biodiesel, CNG, and electric to 10% by 2025.	10%	2025	No Data	N/A[2]
THERMAL	**10 V.S.A. 581 (2007):** Improve the energy fitness of at least 20% of the state's housing stock (total 2007 = 300,000 units) by 2017, and 25% by 2020.	60,000 80,000	2017 2022	27,186 (2018)[6]	↓
	10 V.S.A. 581 (2007): Reduce the annual fuel needs and fuel bills by an average of 25% in housing units served.	25% average savings per house	2017	26% (2017)[6]	↑
	CEP (2016): Install 35,000 cold climate heat pump systems by 2025.	35,000	2025	17,717[7]	↑
	CEP (2016): Increase wood's share of building heat to 35% by 2030.	35%	2030	26% (2018)[8]	↑
ELECTRICITY	**30 V.S.A. 8002 (2015):** RES Tier 1: Total Renewable Electric — Obtain 55% of annual electric sales from renewables for each retail electricity provider in Vermont by 2017, and 75% by 2032. RECs retained (in-state and out-of-state).	55% 75%	2017 2032	62% site energy (post REC)[9]	→
	30 V.S.A. 8002 (2015): RES Tier 2: Distributed Generation — Require 1% of electric sales to come from distributed generation in 2017, rising to 10% by 2032. Projects starting in mid 2015 are eligible, and new NM and SO projects count if RECs are retired (in-state).	1% 10%	2017 2032	1.60%	↑
	30 V.S.A. 8005a(c) (2011): Issue Standard Offer contracts to new SO plants until a cumulative capacity of 127.5 MW is reached (new plants 2.2MW or less commissioned on or after Sept 30, 2009). (in-state)	127.5 MW	2022	103.9 MW contracts awarded 70.6 MW projects commissioned[10]	↑

1. Energy Information Administration, calculated from total energy consumed (2019, with 2017 data). **2.** We did not receive new data for these metrics. **3.** Only represents the amount met with Energy Transformation projects, not Tier 2 RECs that were used for Tier 3 compliance. All utilities were compliant with Tier 3 requirements. **4.** Vermont Agency of Natural Resources. Department of Environmental Conservation: Air Quality and Climate Division. January 2020. 2019 Greenhouse Gas Emissions Inventory Brief (1990–2016). **5.** All Transportation data (except emissions data) from the UVM Transportation Research Center. **6.** Department of Public Service. 2019 Building Energy Report. **7.** Efficiency Vermont (2019, with 2018 data). Assumes rebates cover 75% of heat pumps sold. **8.** Biomass Energy Resource Center, VEIC. 2016. Wood Heating in Vermont: A Baseline Assessment. **9.** Department of Public Service. Utilities were obligated to retire RECs equivalent to 55% of retail sales in 2018, the second full year of REC compliance. **10.** Department of Public Service.

90% by 2050: Meeting the first milestone (2025)

Tracking Progress of Key Technology Pathways

SECTOR	UNIT	2010 Baseline	Latest Achieved[1]	2025 Energy Milestone[2]	2025 EAN Path to Paris*	2050 Energy Milestone[2]	EAN Target Description
TRANSPORTATION							
Electric Vehicles & Plug-in Hybrids[3]	# of Vehicles	100	**3,288**	**45,000**	90,000	269,500	Total number of electric vehicles and plug-In hybrids
			0.71%	**10%**	19%	70%	% of light-duty vehicle fleet (LVF)
Light-Duty Vehicle Fleet Efficiency (LVF) (combustion engines only)	Fleet MPG	20.3	**22.7**	**24.1**	24.1	32.4	
		N/A	**12%**	**19%**	19%	50%	% fuel efficiency increase of LVF combustion engine fleet (over 2010)
Commercial/Industrial Fleet Efficiency	Fleet MPG	6	**N/A**	**6.9**	6.9	9	
		N/A	**N/A**	**15%**	15%	50%	% fuel efficiency increase for commercial/industrial fleet (over 2010)
Biofuels[4]	Million Gallons	28.7	**32.3**	**40**	N/A	211	
		5%	**5.7%**	**12%**	N/A	90%	% of total fuel use for combustion engine fleet (LVF, commercial, industrial). Aviation not included.
Single Occupancy Vehicle Commute Reduction	% Commute Trips	79.2%	**81.4%**	**67%**	64%	50%	% of work commute trips in single occupancy vehicle
Public Transit Ridership Increase	Annual Riders (millions)	4.58	**4.74**	**8.7**	8.7	17.4	Total annual public transit ridership
			+2%	**90%**	90%	280%	% increase/decrease from baseline
Total Transportation Energy	TBTU	50.6	**48.2**	**39.1**	38.5	31.5	Total energy used for transportation
Renewable Energy Share	%	4.5%	**5.6%**	**10%**	15%	85%	% of total transportation energy from renewable resources
THERMAL							
Building Efficiency Savings	Trillion BTU (TBTU)	0.04	**2.03**	**4.12**	4.50	11.30	Cumulative energy savings from building efficiency
		N/A	**5%**	**10%**	11%	30%	% increase in energy savings for building heating/ cooling over 2010
Wood Heat	TBTU	10.2	**12.56**	**10.26**	10.26	9.0	Includes cordwood, pellets, and woodchips
		25%	**26%**	**28%**	28%	35%	% of heating demand met by biomass (residential & commercial)
Biofuels	TBTU	0	**0.28**	**0.62**	N/A	4.0	
		0%	**0.6%**	**2%**	N/A	15%	% of heating demand met by liquid biofuels (residential & commercial)
Heat Pumps	Total # of heat pump systems	0	**16,255**	**35,000**	90,000	160,000	
		0%	**0.7%**	**7%**	18%	43%	% of heating/cooling demand met by cold climate heat pumps (residential & commercial)

Total Thermal Heat Load	TBTU	41.2	**47.6**	**37.1**	30.8	26.6	VT residential & commercial heating/cooling load
		N/A	**16%**	**-10%**	-25%	-30%	% energy reduction/increase for building heat over 2010
Total Industrial Heat & Process	TBTU	8.4	**6.7**	**8.5**	8.5	6.5	Thermal energy for industrial heat & manufacturing processes
Total Thermal	TBTU	49.6	**54.3**	**45.6**	39.3	33.1	Total thermal energy including industrial process
Renewable Energy Share	%	22%	**27%**	**27%**	35%	93%	% of total thermal energy from renewable resources
ELECTRIC							
Wind[5]	Megawatts	7.4	**284**	**350**	441	650	Cumulative MW capacity from in-state & regional wind
		0.3%	**11% / 0.1%**	**11%**	19%	21%	% of total electric power: pre-REC/post-REC
Solar[5]	Megawatts	11	**332**	**550**	744	1,500	Cumulative MW capacity from solar
		0.2%	**6% / 2%**	**10%**	16%	24%	% of total electric power: pre-REC/post-REC
Hydro (VT small)	Megawatts	190	**200**	**215**	N/A	225	Cumulative MW capacity from small-scale hydro
		10%	**14% / 12%**	**13%**	N/A	9%	% of total electric power: pre-REC/post-REC
Hydro-Québec (import)	Megawatts	400	**218**	**218**	N/A	600	Existing Hydro-Québec contract (2012) remains unchanged until 2030
		31%	**24% /49%**	**20%**	N/A	40%	% of total electric power: pre-REC/post-REC
Methane (Farm and Landfill Methane)	Megawatts	3	**18**	**22**	26	45	Cumulative MW capacity from farm and landfill methane
		0.3%	**2% / 0%**	**2.1%**	2.5%	3.5%	% of total electric power: pre-REC/post-REC
Total Electric Generation[6]	Gigawatt Hours	5,665	**5,525**	**5,958**	6,225	8,250	Total electric retail sales
Electric Renewable Share[7]	%	N/A	**62%**	**67%**	67%	97%	% of electricity sales from renewable resources (post-REC)
Total Electric Energy Use	TBTU	18.6	**16.5**	**16.0**	16.0	20.0	Retail electrical use, excluding Transportation and Thermal sectors
Total Energy Demand	TBTU	119	**119**	**101**	94	85	Total site energy used in all sectors
Total Renewable Energy %[9]	%	21%	**24%**	**25%**	28%	90%	% of total site energy from renewable resources

***** To meet the GHG reductions in EAN's Path to Paris would require a greater adoption of selected renewable technologies than those indicated in the 2025 goals of the Comprehensive Energy Plan (CEP). Both are included here to demonstrate the difference.

1. Transportation data is the latest available from the Energy Information Administration (EIA) (2019), the UVM Transportation Research Center (2019), and Drive Electric Vermont (Oct 2019). Thermal data from EIA (2019), Efficiency Vermont (2019), Vermont Gas (2019), and the Department of Public Service (PSD) (2019). Electric data from the PSD (2019) and Certificates of Public Good (ePUC September 2019). N/A indicates incomplete or unavailable data.

2. Projections are those of EAN, building upon the 2016 CEP's 25% by 2025 milestone.

3. Assumes a 50% split between EVs and PHEVs by 2025. As of 2019, PHEVs are 62% of EV fleet.

4. Includes Light Vehicle Fleet (LVF) and Commercial-Industrial Fleet (CIF). Includes corn-based ethanol used as gasoline additive (5%).

5. Installed wind and solar as of September 2019 (from EAN Atlas data), including all operational net metering, Standard Offer, and SPEED projects.

6. VT 2018 Utility Retail Sales. 2050 GWH total based on EAN estimate.

7. Electric Renewable Energy % based on utility retail sales. Accounts for REC transactions.

8. Based on 2018 Vermont electric sector data. Allocations to Transport and Thermal Sectors done by EAN.

9. Total Renewable Energy % is based on Department of Public Service site data and accounts for REC transactions after 2017.

Who We Are

Energy Action Network (EAN) consists of over 100 active members representing business and finance, utilities, non-profits, and higher education, along with over 100 local, state, and federal public partners. All EAN members share a mission of achieving Vermont's 90% renewable by 2050 total energy commitment and of significantly reducing Vermont's greenhouse gas emissions in ways that create a more just, thriving, and sustainable future for Vermonters.

Business and Finance

3E Thermal
Randy Drury, Fritz Fay

AllEarth Renewables
David Blittersdorf

Bee the Change
Mike Kiernan

Bourne's Energy
Peter Bourne, Levi Bourne, Jim Kurrle

Black Bear Biodiesel
Jim Malloy

Building Energy
Russ Flanigan

Built by Newport
Dave Laforce

Butternut Mountain Farm
David Marvin, Ira Marvin, Emma Marvin

Casella
Joe Fusco

Catalyst Financial
Bob Barton, Marianne Barton

Catamount Solar
Kevin McCollister

Dynapower
Adam Knudsen, Richard Morin

EAPC Wind Energy
Robert Sherman

Eco-Equipment Supply, LLC
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Energy Co-op of Vermont
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Gardener's Supply
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Green Lantern Group
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Harrison Grubbs

Maclay Architects
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MMR
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Montpelier Construction
Malcolm Gray

National Life Group
Ross Sneyd, Charlie Maitland

New Leaf Design
Tom Perry

Norwich Solar Technologies
Jim Merriam, Joel Stettenheim, Martha Staskus

NRG Systems
Justin Wheating, Anna Grady

Optimal Energy
Elizabeth Chant

Packetized Energy
Kate Desrochers

Pellergy
Andy Boutin

Pomerleau Real Estate
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rbTechnologies
Rubin Bennett

Regulatory Assistance Project (RAP)
Rich Cowart, Rick Weston, David Farnsworth

Reiss Building and Renovation
Chuck Reiss

Seventh Generation
Ashley Orgain

SunCommon
James Moore, Duane Peterson

Sunrun
Chris Rauscher

Sunwood Biomass
David Frank

Union Mutual Insurance
Michael Nobles

Vanesse Hangen Brustlin, Inc (VHB)
Carla Fenner

Vermont Economic Development Authority (VEDA)
Sam Buckley

Vermont Housing and Finance Agency
Maura Collins

Vermont Wood Pellet Co.
Chris Brooks

VSECU
Rob Miller, Laurie Fielder, Simeon Chapin, Lisa LaSante

Nonprofits

Associated Industries of Vermont (AIV)
William Sayre

Audubon Vermont
David Mears, Margaret Fowle

Biomass Energy Resource Center
Adam Sherman

Building Performance Professionals Associations of Vermont
Jonathan Dancing, Malcolm Gray, Russ Flanigan, Chuck Reiss, Tom Perry

Capstone Community Action
Sue Minter, Paul Zabriskie

Champlain Valley Office of Economic Opportunity (CVOEO)
Dwight DeCoster

Conservation Law Foundation
Jen Duggan, Sandy Levine

Drive Electric Vermont (DEV)
David Roberts

Fairbanks Museum
Adam Kane

Fresh Energy (Minnesota)
Rob Davis

Intervale Center
Travis Marcotte

Lake Champlain Regional Chamber of Commerce
Tom Torti, Catherine Davis, Austin Davis

Local Motion
Karen Yacos

NeighborWorks of Western Vermont (NWWVT)
Ludy Biddle, Melanie Paskevich

New England Grassroots Environmental Fund (NEGEF)
Julia Dundorf

Northeastern Vermont Regional Hospital
Laural Ruggles

Northern Forest Center
Rob Riley, Maura Adams, Joe Short

Public Assets Institute
Stephanie Yu

Renewable Energy Vermont (REV)
Olivia Campbell-Andersen, Lisa Cline

Shelburne Farms
Marshall Webb, Megan Camp

UVM Medical Center
Dawn LeBaron

The Nature Conservancy
Heather Furman, Phil Huffman, Lauren Oates, Eve Frankel

Vermont Businesses for Social Responsibility (VBSR)
Jane Campbell

Vermont Climate and Health Alliance
Dan Quinlan

Vermont Council on Rural Development (VCRD)
Paul Costello, Jenna Koloski, Jon Copans, Margaret McCoy

Vermont Energy and Climate Action Network (VECAN)
Johanna Miller

Vermont Energy Education Program (VEEP)
Cara Robechek, Mariah Keagy, Stephen Knowlton, Andy Shapiro

Vermont Energy Investment Corporation (VEIC)
Jim Madej, Damon Lane, Jennifer Wallace-Brodeur, Richard Donnelly, Justine Sears, Kelly Lucci, Barry Hulce

VT Independent Power Producers Association
Mathew Rubin

Vermont Interfaith Power and Light
Ron McGarvey, Sam Swanson, Betsy Hardy

Vermont Land Trust
Nick Richardson, Abby White

Vermont League of Cities and Towns (VLCT)
Karen Horn, Abby Friedman

Vermont Natural Resources Council (VNRC)
Brian Shupe, Johanna Miller, Kate McCarthy, Jamey Fidel, Ian Hitchcock

Vermont Passive House
Chris Clarke Miksic, Paul Sipple, Enrique Bueno

Vermont Public Interest Research Group (VPIRG)
Paul Burns, Ben Edgerly Walsh

Vermont Sustainable Jobs Fund (VSJF)
Ellen Kahler, Janice St Onge, Christine McGowan, Jake Claro, Geoff Robertson

Vermont Vehicle and Automotive Distributors Association (VADA)
Marilyn Miller

Vital Communities
Tom Roberts, Sarah Brock, Bethany Fleishman

Utilities

Burlington Electric Department
Darren Springer, Mike Kanarick, Jennifer Green, Tom Lyle, Chris Burns, Mike Russom

Efficiency Vermont (EVT)
Rebecca Foster, Dan Reilly, Sarah Wolfe

Green Mountain Power (GMP)
Mari McClure, Brian Otley, Robert Dostis, Kristin Carlson, Josh Castonguay, Jeff Monder

Hardwick Electric Department
Mary Westervelt

Vermont Electric Power Company (VELCO)
Tom Dunn, Kerrick Johnson, Colin Owyang, Mark Sciarotta, Lou Cecere, Shana Louiselle

Vermont Electric Cooperative (VEC)
Rebecca Towne, Andrea Cohen, Jake Brown

Vermont Gas
Don Rendall, Tom Murray, Lauren Grimley, Tiana Smith

Vermont Public Power Supply Authority (VPPSA)
Ken Nolan, Melissa Bailey

Washington Electric Co-op (WEC)
Patty Richards, Barry Bernstein, Roger Fox

Higher Education

Champlain College
Neale Lunderville

Dartmouth College, Tuck School of Business
April Salas

Goddard College
Catherine Lowther

Middlebury College
Diane Munroe, Dan Suarez

Norwich University, Center for Global Resilience and Security
Tara Kulkarni

University of Vermont (UVM)
Jon Erickson, Richard Watts, Amy Seidl, Abby Bleything

UVM Extension
Chuck Ross, Sidney Bosworth, Sarah Tichonuk

UVM Gund Institute
Taylor Ricketts, Jeannine Valcour

UVM Vermont Clean Cities Coalition
Peggy O'Neill-Vivanco

Vermont Law School
Thomas McHenry, Kevin Jones

Vermont Technical College
Pat Moulton

Public Partners

LOCAL

Legislators: *Vermont's State Representatives and Senators*

Town Energy Committees: *Town Energy Committees from across Vermont*

Cities: *Burlington (Mayor Miro Weinberger), Montpelier (Mayor Anne Watson), South Burlington (Paul Conner, Director of Sustainability); Hartford (Geoff Martin, Sustainability Coordinator)*

REGIONAL

Regional Development Corporations: *Adam Grinold (Brattleboro Development Credit Corporation), Dave Snedeker, Alison Low (Northern Vermont Development Association)*

Regional Planning Commissions: *Adam Lougee (Addison), Peter Gregory (Two Rivers Ottauquechee), Jim Sullivan (Bennington County), Melanie Needle and Charlie Baker (Chittenden), Catherine Dimitruk (Northwest), Dave Snedeker and Alison Low (Northern Vermont Development Association), Chris Campany and Marion Major (Windham), Bonnie Waninger (Central Vermont)*

Green Mountain Transit Regional Transit Authority: *Jenn Wood*

STATE

Agency of Agriculture, Food and Markets: *Anson Tebbetts, Diane Bothfeld, Alex DePillis*

Agency of Commerce and Community Development: *Ted Brady, Ken Jones*

Agency of Natural Resources: *Julie Moore, Peter Walke, Billy Coster*

Agency of Transportation: *Joe Flynn, Michele Boomhower, Dan Dutcher*

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Dept of Environmental Conservation: *Emily Boedecker, Heidi Hales, Collin Smythe, Megan O'Toole*

Dept of Financial Regulation: *Michael Pieciak*

Dept of Forests, Parks and Recreation: *Michael Snyder, Sam Lincoln, Paul Frederick, Emma Hanson*

Dept of Public Service: *June Tierney, Riley Allen, Ed McNamara, TJ Poore, Anne Margolis, Andrew Perchlik, Maria Fischer, Phillip Picotte, Ed Delhagen, Kelly Launder*

Vermont Public Utility Commission: *Anthony Z. Roisman, Margaret Cheney, Sarah Hofmann, Tom Knauer*

Vermont Housing and Conservation Board: *Gus Seelig, Jen Hollar, Craig Peltier*

Vermont Center for Geographic Information (VCGI): *John Adams, Tim Terway*

Vermont Lieutenant Governor: *David Zuckerman*

Vermont State Treasurer: *Beth Pearce*

FEDERAL

Office of Congressman Peter Welch: *Rebecca Ellis*

Office of Senator Bernie Sanders: *Haley Pero*

Office of Senator Patrick Leahy: *Tom Berry, Chris Saunders*

USDA Rural Development, VT/NH Office: *Jon-Michael Muise, Ben Doyle, Ken Yearman*

Mission & goals

Energy Action Network (EAN) works to achieve Vermont's 90% renewable by 2050 total energy commitment and to significantly reduce Vermont's greenhouse gas emissions in ways that create a more just, thriving, and sustainable future for Vermonters.

In addition to EAN's long-term goals, our near-term goals include meeting the 2025 commitments set forth in Vermont's 2016 Comprehensive Energy Plan and achieving emissions reductions as required by the Paris Climate Agreement of at least 26%–28% below 2005 levels by 2025.

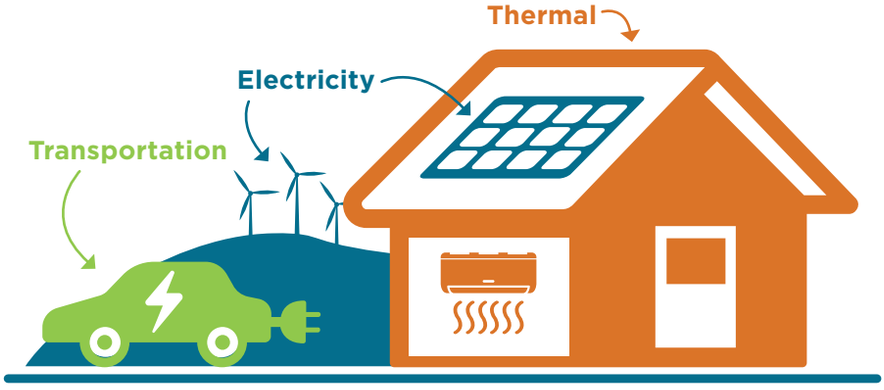
Collective impact approach

Energy Action Network (EAN) is a diverse network of nonprofits, businesses, public agencies, and other organizations working together in a collective impact framework and supported by a core staff to further the Network's mission.

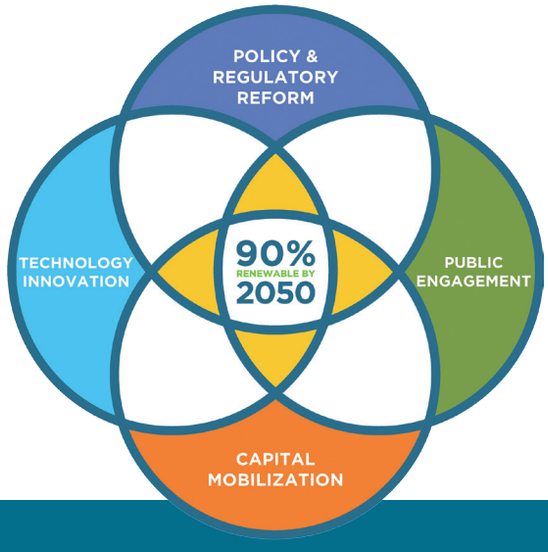
We approach our work together through two key lenses:

1) **Total energy transformation:** We work toward efficient and renewable energy use across all sectors.
2) **Strategic leverage areas:** We work to enable systemic change at a scale and pace necessary to achieve Vermont's energy & emissions commitments.

Total energy transformation



Strategic leverage areas



The core staff of EAN supports the work of Network members in the following ways:

Steward a common agenda for Network members and partners.

Collect data and measure results through regular tracking and analysis of progress.

Coordinate mutually reinforcing activities to develop, share, and advance high-impact ideas.

Ensure continuous communication to and across the Network.

2019 Board of Directors & EAN Staff

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JIM MERRIAM
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Norwich Solar Technologies, CEO

JIM SULLIVAN
EAN Leverage Point Advisor
Bennington County Regional Commission, Executive Director

Thank you!

EAN's 2019 Annual Progress Report for Vermont is a collaborative effort, reflective of our diverse network members and public partners. We would like to thank the following agencies and organizations for their contributions to the content, data, and analysis within the report: the Vermont Department of Public Service, the Agency of Natural Resources, the Agency of Transportation, the Vermont Energy Investment Corporation, and the UVM Transportation Research Center. Special thanks to Ken Jones, Economic Research Analyst at the Agency of Commerce and Community Development and Collin Smythe, Environmental Analyst with the Department of Environmental Conservation's Air Quality and Climate Division and the lead author of Vermont's Greenhouse Gas Emissions Inventory.

The primary co-authors of the report are EAN's core staff — Jared Duval, Pamela Hathaway, and Carolyn Wesley — and EAN Senior Fellow Leigh Seddon. Design and layout is by Dana Dwinell-Yardley: ddydesign.com. Printed in Burlington, VT, by Queen City Printers.

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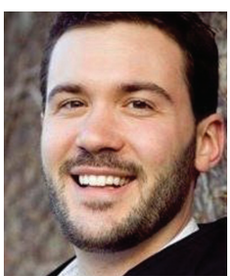

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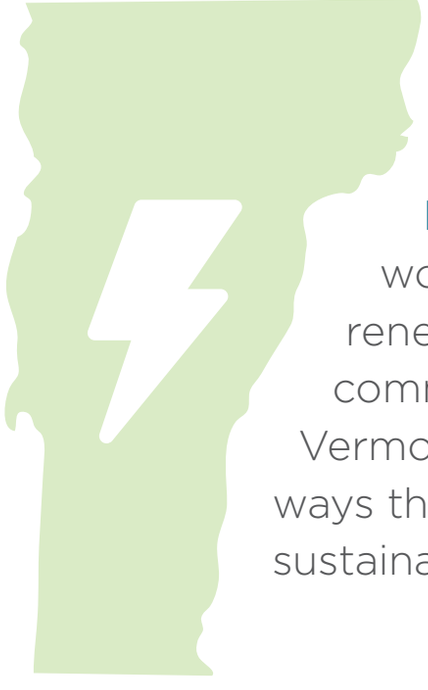

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