ENERGY ACTION NETWORK

90% RENEWABLE BY 2050

The Benefits of Achieving Vermont's ENERGY & EMISSIONS COMMITMENTS

2018 ANNUAL PROGRESS REPORT

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.

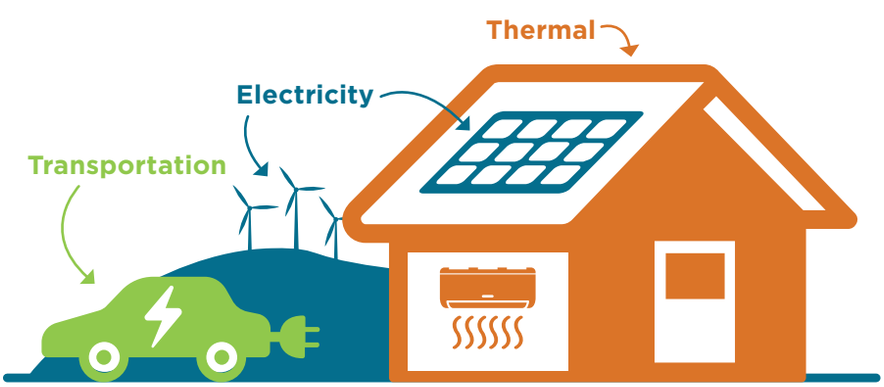
Collective impact approach

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.

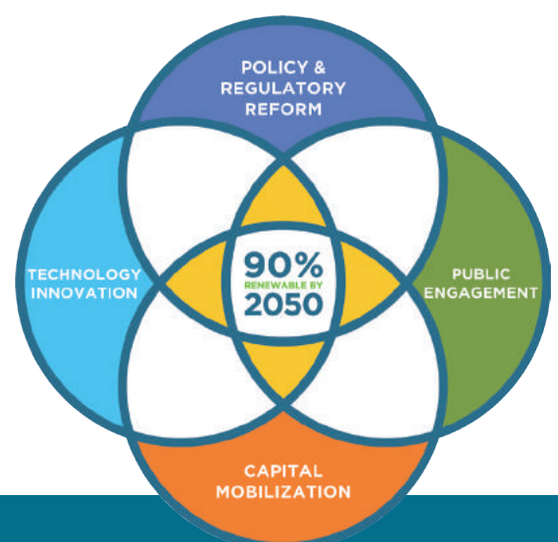
We approach our work together through two key lenses:

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.

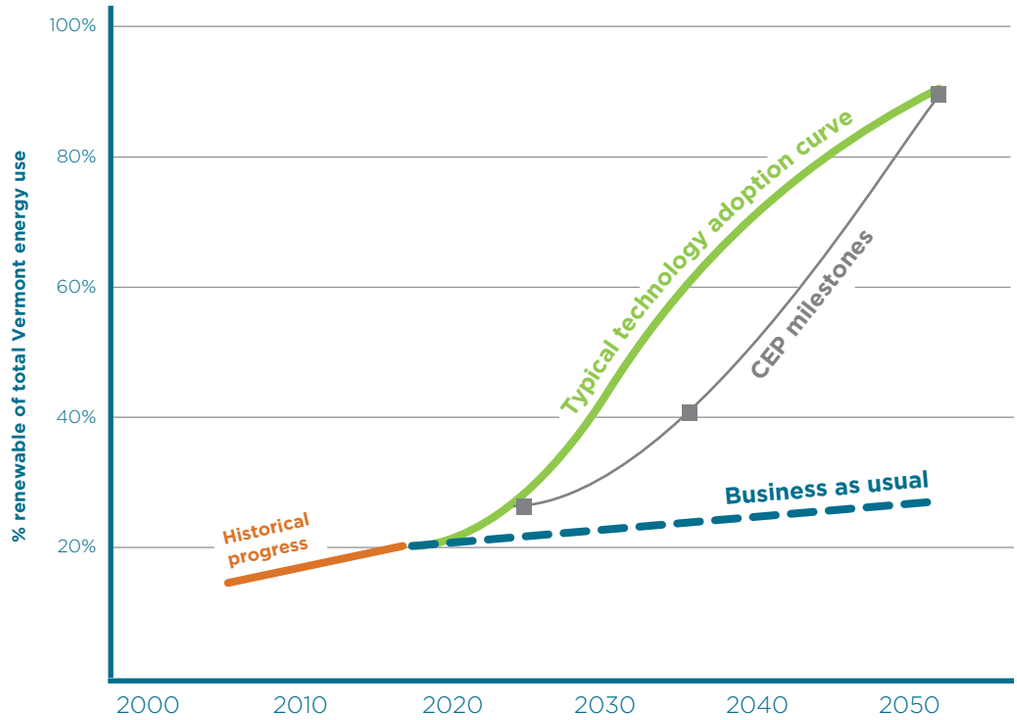
Coordinate mutually reinforcing activities to develop, share, and advance high-impact ideas.

Ensure continuous communication to and across the Network.

It's time to bend the curve

Energy Action Network and the State of Vermont have a shared commitment to achieving **90% renewable energy by 2050,** as outlined in Vermont's 2016 Comprehensive Energy Plan (CEP). The first milestone of the CEP is **25% by 2025.** Recent progress in the electric sector may allow us to meet that milestone, but bending the curve to reach 90% by 2050 will require far more progress in other sectors very soon.

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



The two stories of Vermont

While we're close to meeting our 2025 renewable energy milestone, Vermont has much more to do to meet our commitment to the Paris Climate Agreement by 2025. We've only reduced our greenhouse gas emissions by 2% below 2005 levels — and our emissions are up 16% since 1990.

We can tell two stories about Vermont: a renewable energy leader and a climate laggard. Both are true.

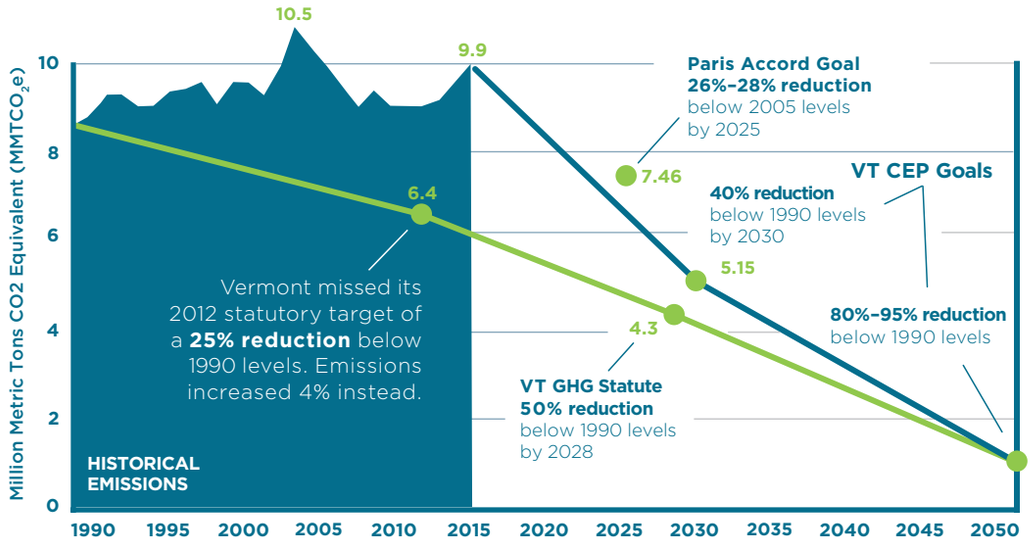
Throughout this report, we identify the areas where we can match our renewable progress with emissions reductions to meet and exceed our commitments by 2025.

1. Historical renewable energy data from the Energy Information Administration, Business as Usual Projection from the VEIC Solar Pathways analysis.

Vermont's greenhouse gas emissions have been increasing despite significant reduction commitments

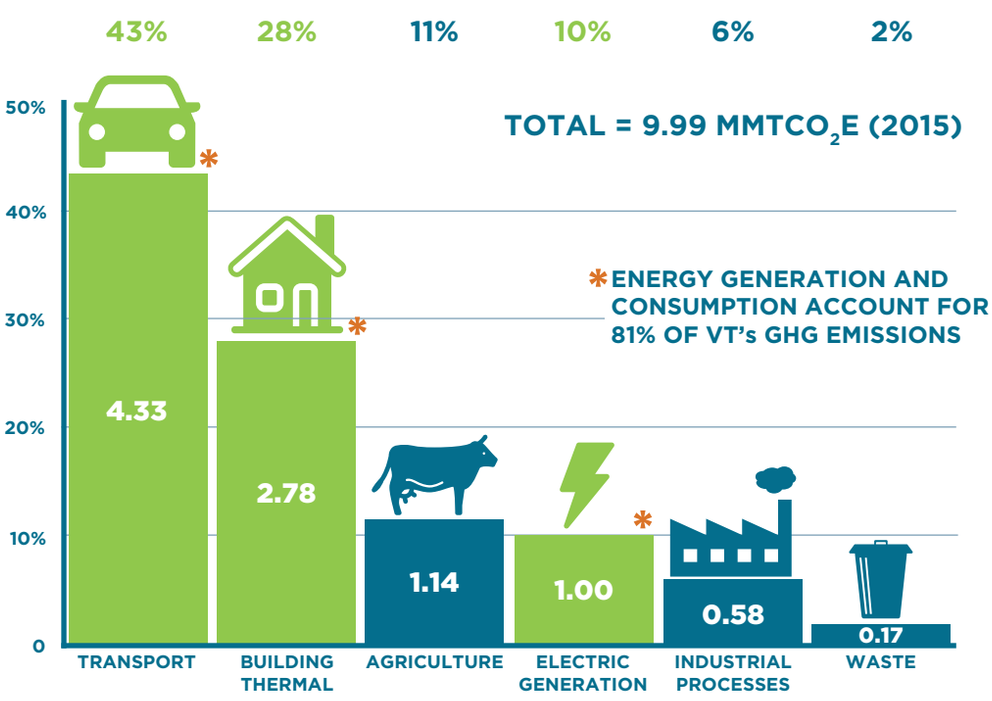
Greenhouse gas (GHG) emissions are on the rise statewide. We are now **16% above 1990 levels,** and just **2% below peak 2005 levels**. Between 2013–2015, emissions from transportation and thermal fuels together accounted for nearly 80% of Vermont's overall emissions increase.[1]

What will it take to meet our commitments?



Transportation & thermal energy are the largest contributors to Vermont's greenhouse gas emissions

Vermont's GHG emissions by sector

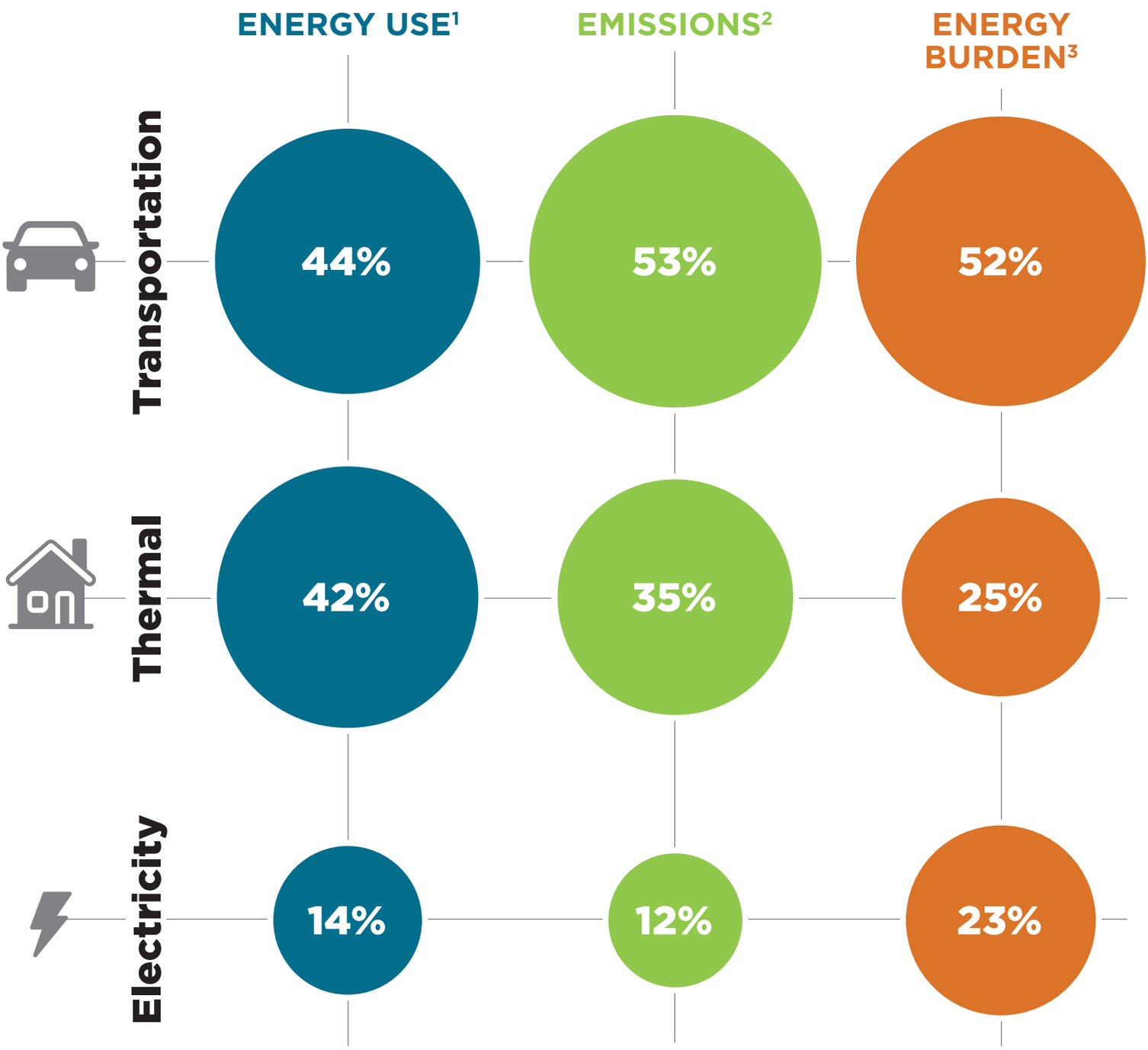


Our two biggest sources of emissions are transportation and thermal energy use, which together cause over 70% of Vermont's GHG pollution. From 2013–2015 (the most recent year for which data is available) energy emissions were responsible for **98% of the GHG increase statewide** (46% from transportation, 33% from thermal, and 19% from electricity).[1]

1. 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources.

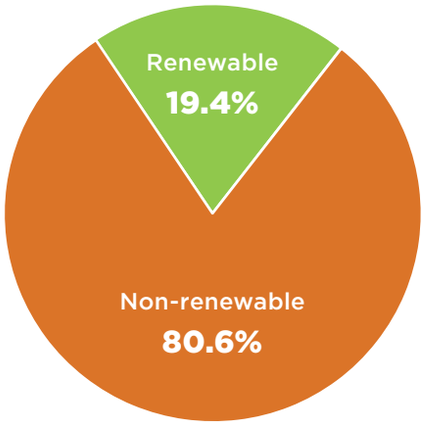
The energy conversation is a climate — and an equity — conversation

Though some may talk about transportation, thermal, and electricity as equal parts of Total Energy, each energy sector is unique in Vermont when it comes to relative energy use, emissions produced, and the energy burden (share of total energy costs for Vermonters) each creates. On all counts, transportation is the biggest challenge.



1. Thermal and transportation based on Energy Information Administration 2016 site energy; Electricity based on Department of Public Service 2017 site energy, after accounting for RECs. **2.** 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources. Percentage based on energy emissions. **3.** Mapping Total Energy Burden in Vermont, Justine Sears, Vermont Energy Investment Corporation (July 2016); Note: VEIC only considered fuel or electricity related costs (not equipment or maintenance costs).

How renewable are we?



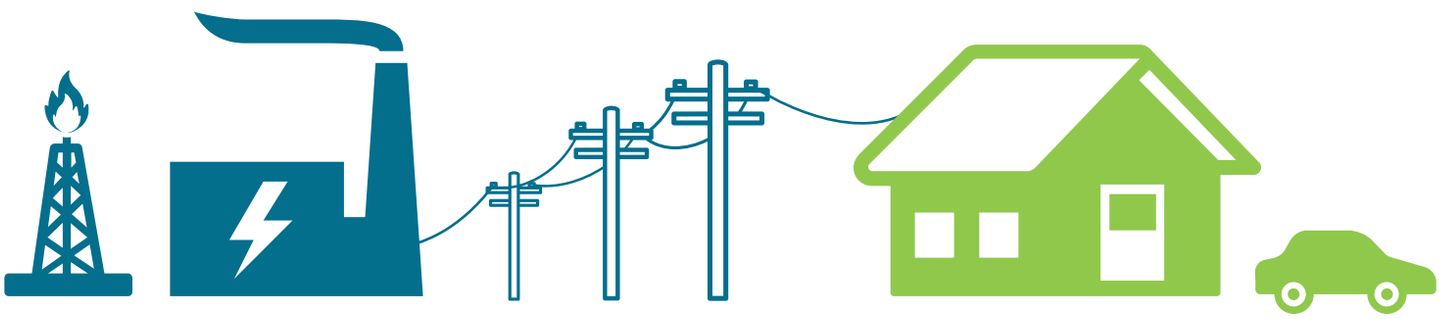
TOTAL ENERGY: 115 TRILLION BTU

19.4% total renewable energy

Total energy in Vermont

In total, Vermont has reached almost 20% renewable across transportation, thermal, and electric energy.[1] That puts our 25% renewable by 2025 Comprehensive Energy Plan target within reach. But it's clear that the majority of this progress has come from the electric sector, with transportation and thermal significantly further behind. Given the relative energy use of those two sectors, much more work will need to happen in thermal and transportation, even to reach 25% renewable.

While the State calculates total energy using **site energy,** energy can also be calculated using **source energy,** which more comprehensively accounts for losses from production and transmission.



Source energy

All energy generated and consumed, including energy lost in production and delivery.

Vermont's total source energy is **18.5% renewable.**

Site energy

Energy directly consumed in buildings and vehicles.

Vermont's total site energy is **19.4% renewable.**

1. Energy Information Administration (2016), Department of Public Service (2017).

MEMBER PROFILE: **Tara Kulkarni**

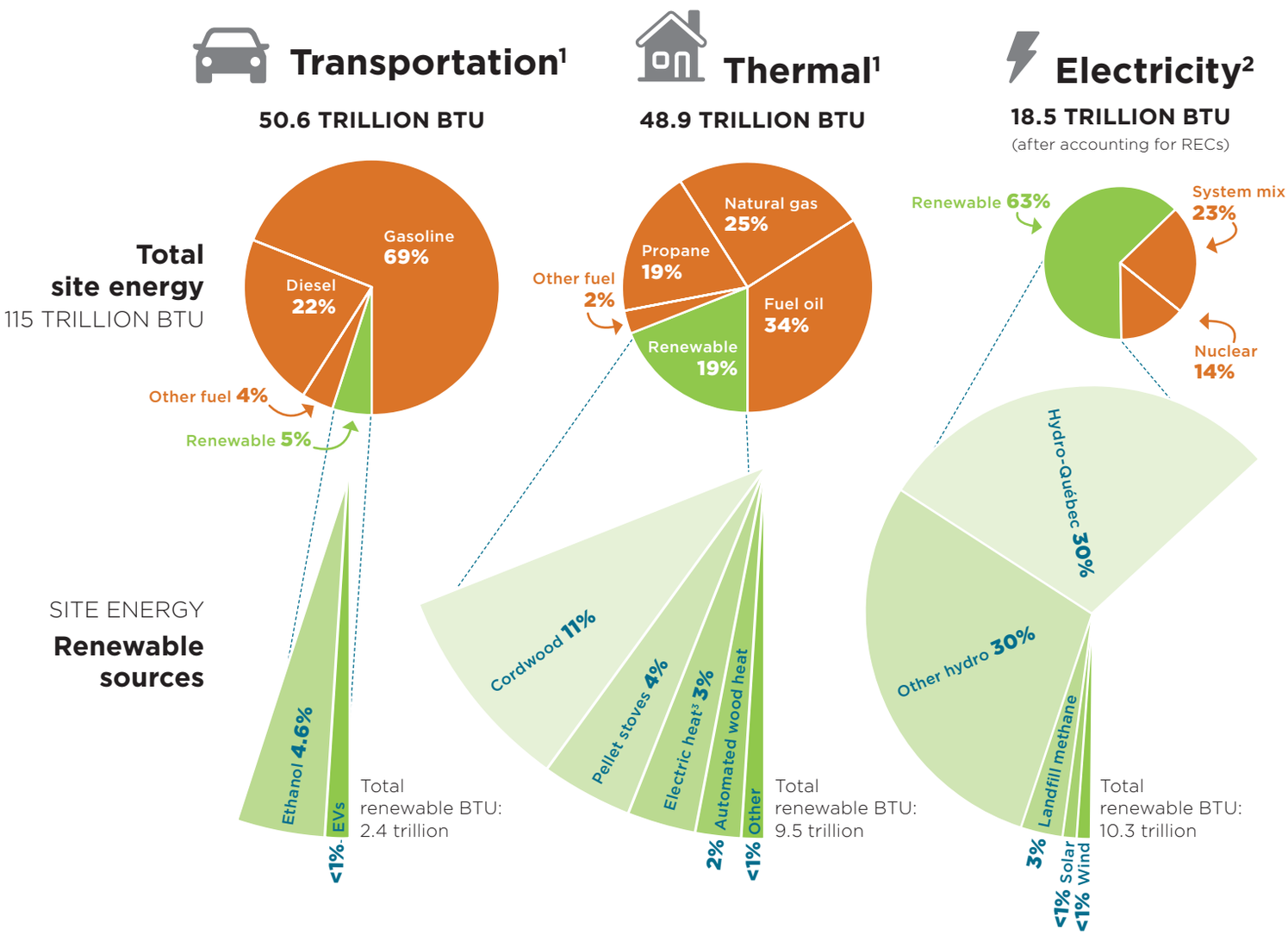
Associate Professor, Department of Civil and Environmental Engineering; Director, Center for Global Resilience and Security, Norwich University

"Resilience is about ensuring that people will always have a reliable source of clean water and food, uninterrupted energy, and a stable home and workplace, regardless of the changes in climate. We believe that complex global challenges can only be solved by creative and innovative teams. That's who we are, researchers and entrepreneurs, seeking to be leaders in climate resilience and security and citizens of this global community."

The Center for Global Resilience and Security (CGRS) at Norwich University (NU), is a community driven research center, focused on the intersections of water, energy, infrastructure, and climate impacts.

Breaking it down by sector

When looking at each sector, it's clear that electricity is the most renewable, at 63%. However, the electric sector only makes up 14% of Vermont's total energy use. Transportation and thermal combined make up 86% of our energy use and are only 5% and 19% renewable, respectively.



1. Energy Information Administration (2016). **2.** Department of Public Service (2017). **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.

MEMBER PROFILE: **Cara Robechek**

Executive Director, Vermont Energy Education Program

"VEEP regularly gets to work with students who are curious, engaged, and want to make the world a better place. We owe our young people the opportunity to learn to use science, technology, and critical thinking skills to help create a more sustainable future."

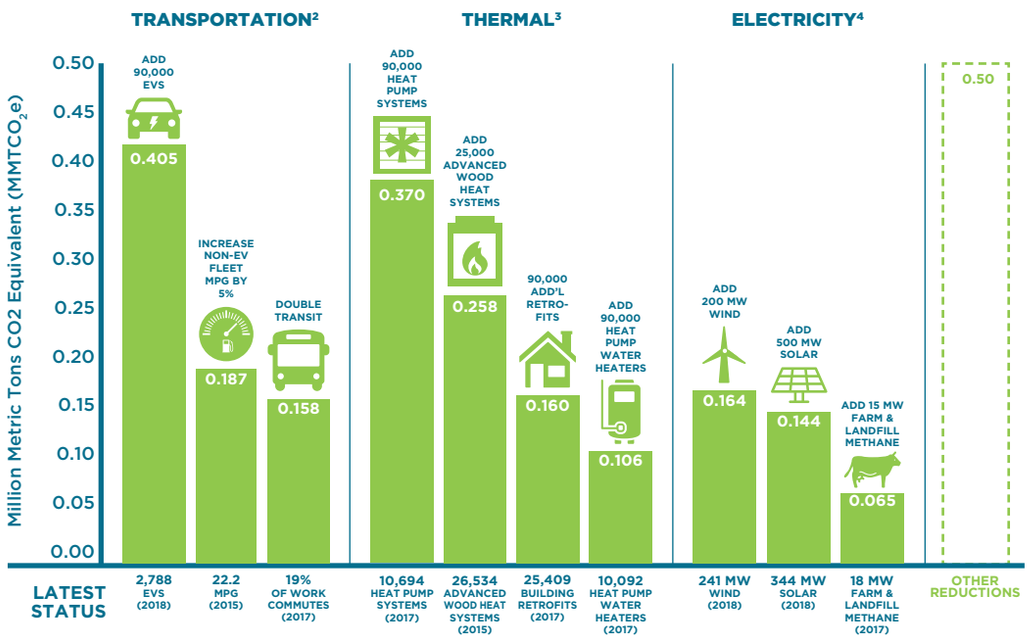
VEEP works to build a deep understanding of energy through education, encouraging choices that result in sustainability in our communities, economy and environment. VEEP has supported hands-on energy and climate education in more than three-quarters of Vermont schools.

What would it take to meet our Paris commitment?

Path to Paris: EAN has modeled one path for how Vermont could achieve our Paris Climate Agreement commitment based on currently available energy technologies and proven best practices.

Getting to the Paris commitment would require **all of these efforts,** plus 20% more from additional measures. For example, if Vermont put fewer than 90,000 EVs on the road, we would have to make up the difference in another area in order to meet the commitment.

2.53 MMTCO$_2$e reduction by 2025 is required to meet the Paris Agreement[1]



The 20% buffer captures additional carbon reductions necessary by 2025 including:

- Non-energy related emissions reductions strategies, for instance carbon sequestration in forestry or agriculture.
- New products or technology advancements that we don't yet have sufficient data to model, including electric lawnmowers and other off-road and farm vehicles.
- Reduction in energy consumption due to efficient technology advancements, increased fossil fuel prices, or fewer heating degree days.

1. EAN calculations based on relative emissions reductions in MMTCO2e based on 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources. **2.** EVs assumes 50% AEV and 50% PHEV. Transit includes direct reduction of single occupancy vehicle commutes through buses, trains, rideshare, vanpool, etc. **3.** Heat pumps and heat pump water heaters assume switching from oil or propane heaters to 75% renewable electricity. Advanced wood heat includes automated, central wood heat systems and pellet stoves. Weatherization assumes project results in 25% reduction in energy use (the statutory goal). **4.** Wind includes imported wind, since there are no plans to build wind in Vermont prior to 2025.

MEMBER PROFILE: **Andy Boutin**

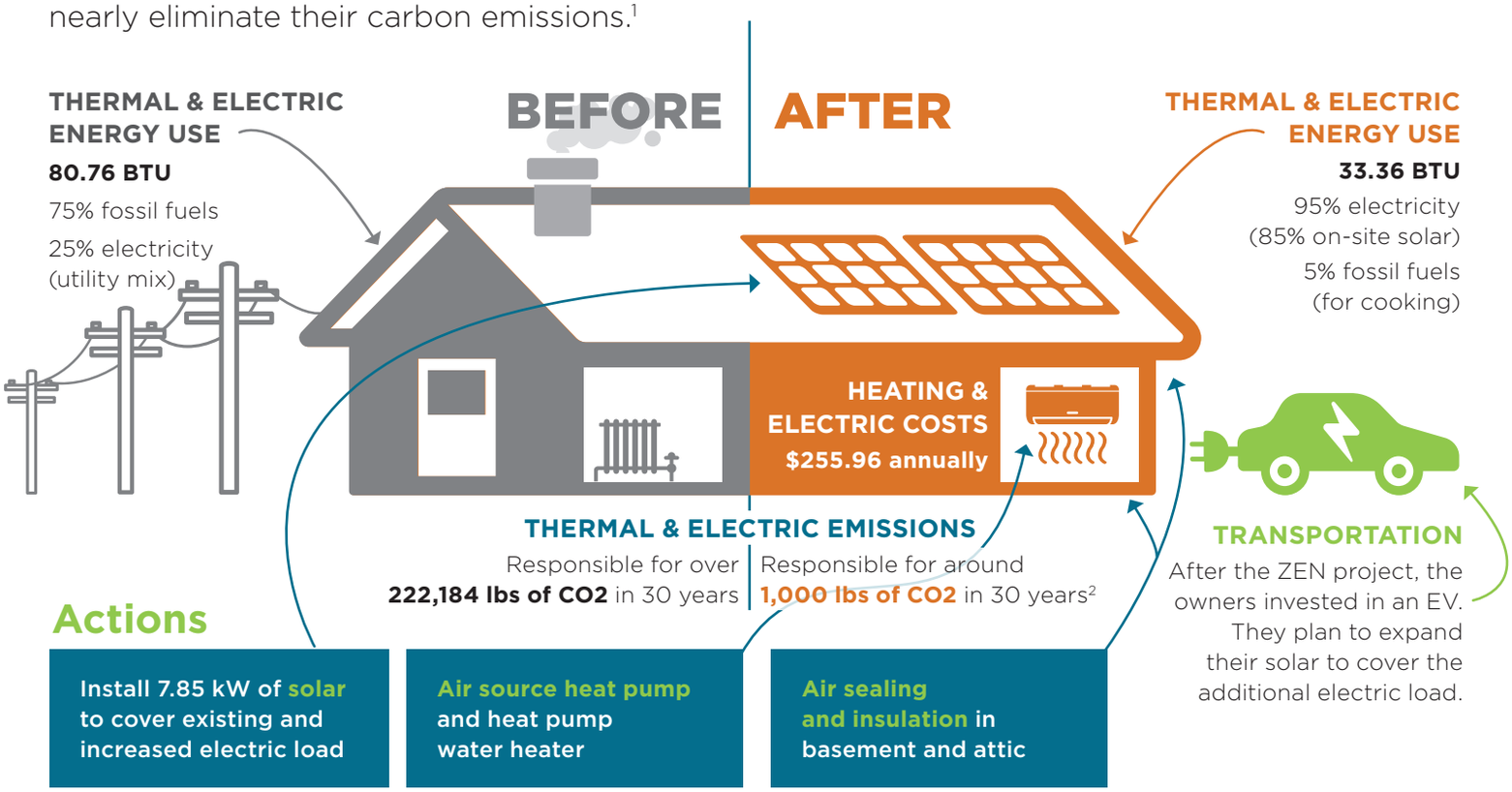
General Manager, Pellergy, LLC

"Pellergy LLC, is a Vermont owned and locally operated company that is dedicated to the manufacture, distribution, and sale of wood pellet heating systems. We enable our customers to reduce their carbon footprint by reducing their reliance on fossil fuels for heating and using our local, sustainable, and renewable wood pellet fuel in fully automated boilers."

Pellergy distributes our Automated Wood Heating systems throughout North America and works with dozens of local installers in New England. Our pellet heating systems are installed in over 400 homes and businesses offsetting tens of thousands of gallons of fossil fuels each year.

How Vermonters benefit: a case study

Let's take a look at a real 1950 ranch house in Jericho, Vermont. The homeowners, one recently retired from the Vermont Air National Guard and one a bookkeeper at a local school district, recently completed a Zero Energy Now (ZEN) project to get their home off fossil fuels and nearly eliminate their carbon emissions.[1]



FINANCING: The couple opted to roll the costs of these home energy improvements into a five year home equity loan to start as their mortgage was retired. Before the project, they were paying $930.45 for their mortgage and energy costs. After the project and the retirement of their mortgage, they are paying $873.61 for a five-year period. Once the loan is retired in 2021, their monthly costs will just be for energy, at a little over $20/month.

Much of this recirculates in the local economy, supporting **seven Vermont businesses and their employees.**

1. Zero Energy Now (ZEN), Building Performance Professionals Association. Note: The ZEN project only included thermal and electric energy projects, so all cost and emissions figures are only related to those two sectors. **2.** Extrapolated by EAN based on energy use post-ZEN project.

MEMBER PROFILE: **Richard Faesy**

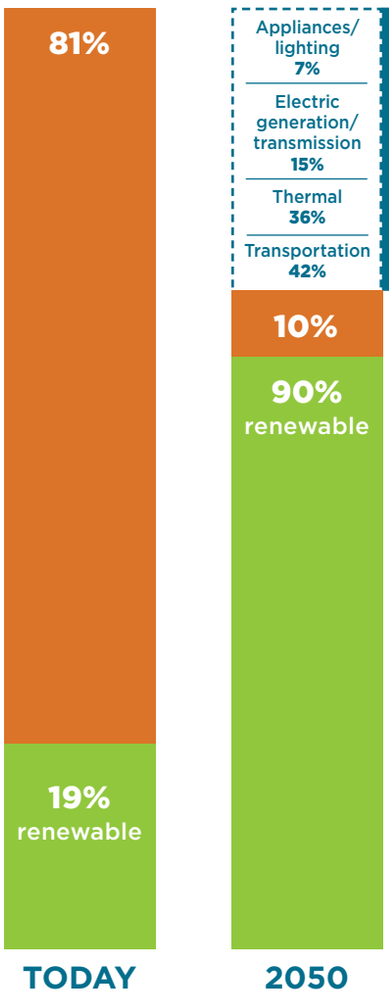
Principal, Energy Futures Group of Hinesburg, VT

"We'd like to think our work on advancing heat pumps, energy code development, implementation of Zero Energy Now, legislative advocacy and multiple papers, presentations and pitches have helped Vermont move closer to our energy goals. And, our net zero office demonstrates how even in Vermont, we can produce 100% of our energy from the roof."

Energy Futures Group is a consulting firm specializing in the design, implementation, and evaluation of programs and policies to promote investments in clean energy.

We can't get there without efficiency

What will it take to reach 90% by 2050?



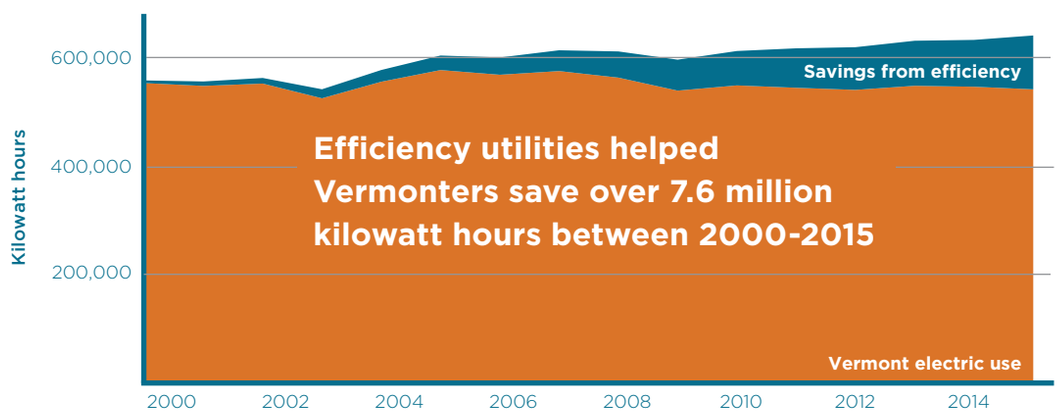
Total energy efficiency

30% savings from efficiency

Efficiency isn't just about decreasing the amount of energy we use for our current electric, heating, and transportation systems. We also achieve (often far larger) efficiency gains when we switch from fossil fuel combustion systems to more technologically advanced renewable systems that use much less energy.[1]

We can do it — we already have

Electric savings from Efficiency VT & Burlington Electric Department (2000-15)[2]



However, our electric use can't keep going down. As we strategically electrify more of our transportation and heating, electric use will have to go up. But this increase in electrification will significantly decrease total energy use and drive down emissions statewide.

1. EAN Pathways Analysis. **2.** Department of Public Service, Response to Joint Energy Committee, Jan. 2016; and the Energy Information Administration.

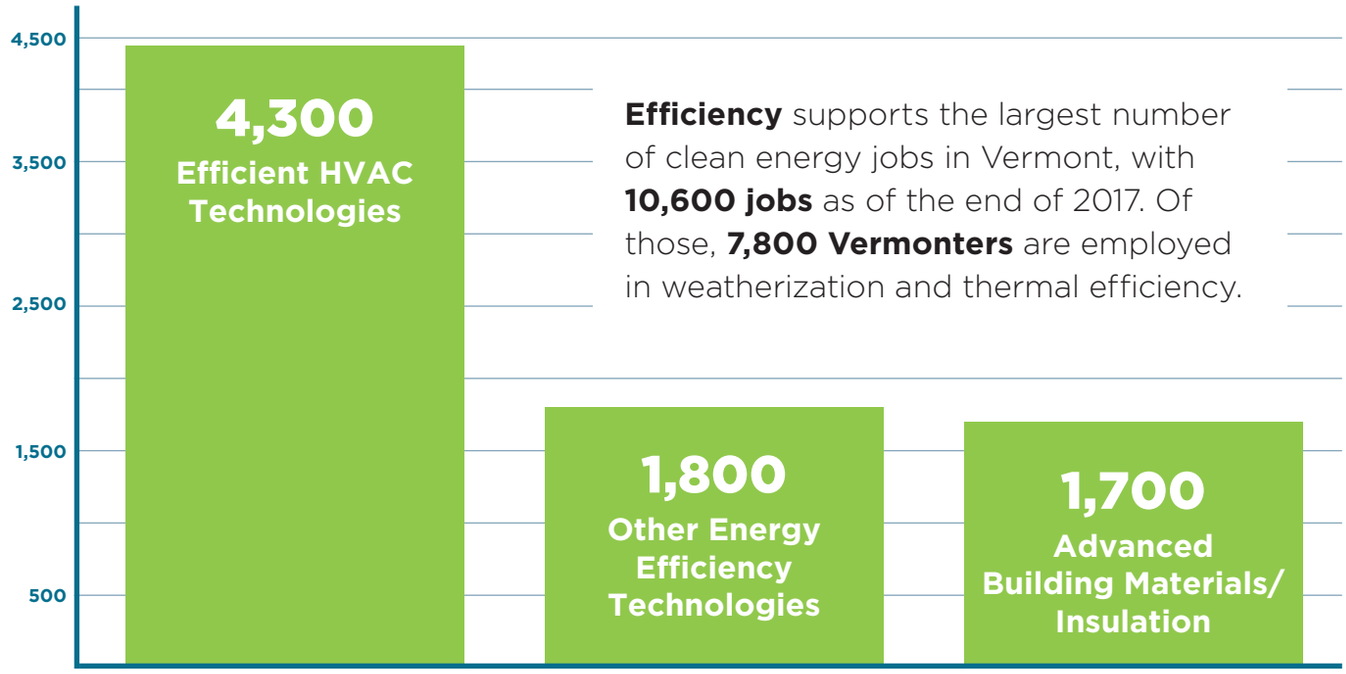
MEMBER PROFILE: **Abby White**

Director of Marketing, Communications & Public Affairs, Efficiency Vermont

"Our customers look to us for straightforward solutions to help them save money and live more comfortably. Whether you're a homeowner on a fixed income, a small business owner, or operator of a large manufacturer, Efficiency Vermont provides services and incentives to help you reduce energy use and lower your costs."

Founded in 2000, Efficiency Vermont is the statewide resource for advancing sustainable energy solutions. Through technical services and financial support, we help Vermont homeowners and businesses reduce energy use, save money, and live more comfortably.

Jobs in weatherization & thermal efficiency[1]

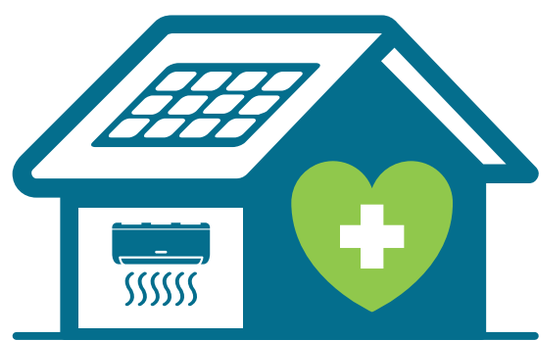


Efficiency supports the largest number of clean energy jobs in Vermont, with **10,600 jobs** as of the end of 2017. Of those, **7,800 Vermonters** are employed in weatherization and thermal efficiency.

Healthy homes, healthy lives

The Vermont Department of Health reports strong evidence for the positive impact of home weatherization on general health, productivity, social health, and upper respiratory health.

They estimate that the **10-year benefit of weatherization,** in health and fuel savings, **is nearly three times greater than the initial investment** per household.[2]



1. Vermont 2018 Clean Energy Industry Report, Clean Energy Development Fund, VT Department of Public Service. **2.** Weatherization + Health in Vermont (2018), VT Department of Health.

MEMBER PROFILE: **Brian Gray**
General Manager, The Energy Co-op of Vermont

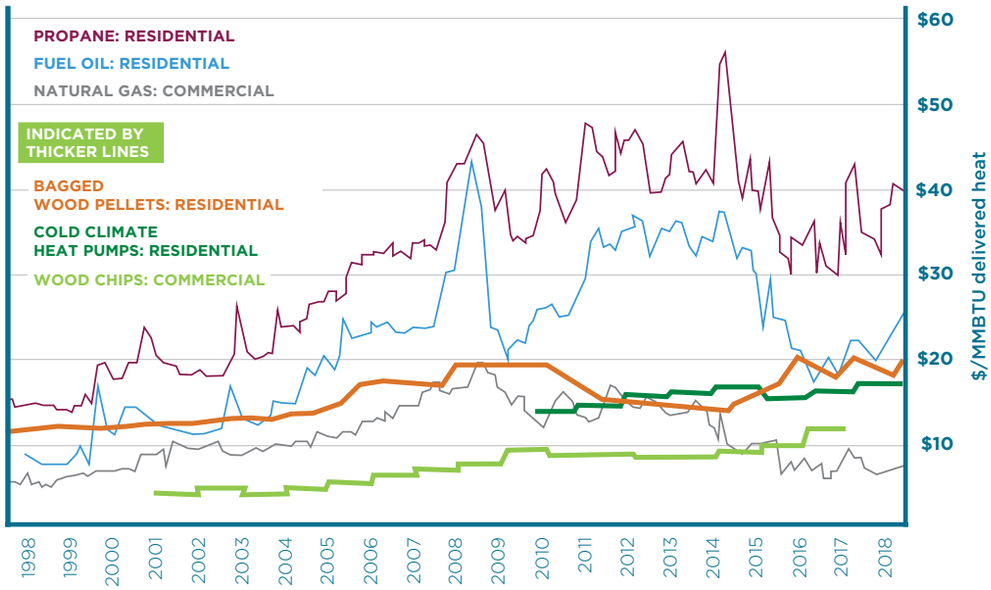
"The Energy Co-op is proud to collaborate with Vermont homeowners to provide reliable and affordable home heating services. We offer efficiency advice and provide tailor-made pathways to reduce energy consumption that encourage our members to 'Use Less and Save More.'"

The Energy Co-op of Vermont is a unique member-owned energy company serving northwestern Vermont since 2001. Our mission is to help Vermonters make their homes more comfortable, healthy and energy-efficient while providing services that help transition them to cleaner-burning and renewable fuels.

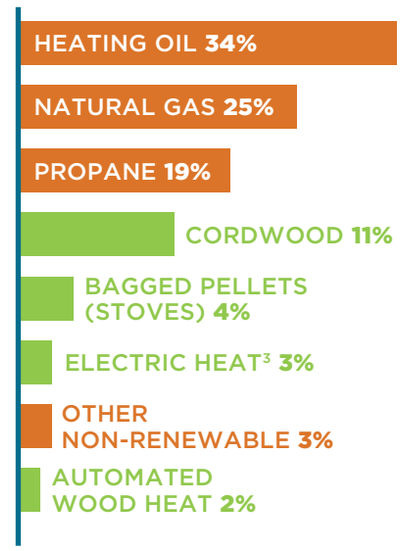
Fossil fuels are a strain on Vermonters and a drain on the Vermont economy

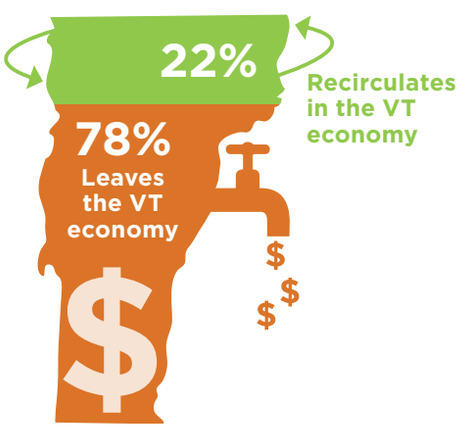
Prices for fossil fuels like propane and fuel oil have historically been the highest and most volatile. Weatherizing your home or business can cut these costs by reducing energy use. Even better, switching to renewable heating options offers lower and more stable fuel prices.

Average heating fuel pricing (1998-2018)[1]



VT Heat Energy Sources[2]





Dollars Spent on Fossil Fuels

Because 78% of Vermonters were heating their homes with fossil fuels, Vermonters spent nearly an extra **$240 million in 2018** on heating fuel than if we were getting 100% of our heat from renewable sources.[4] Of that, over **$185 million left the Vermont economy entirely.[5]**

1. Compiled by Biomass Energy Resource Center (2018) using data from Vermont Department of Public Service and the US Energy Information Administration. **2.** Fossil Fuels: Energy Information Administration (2016); Renewable Fuels: Biomass Energy Resource Center (2014) and VEIC (2017). **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. **4.** Based on 2018 energy prices. **5.** Extrapolated from Vermont Agency of Commerce and Community Development analysis that 78% leaves the state (2018).

MEMBER PROFILE: **Adam Sherman**

Senior Consultant, Biomass Energy Resource Center (BERC) at VEIC

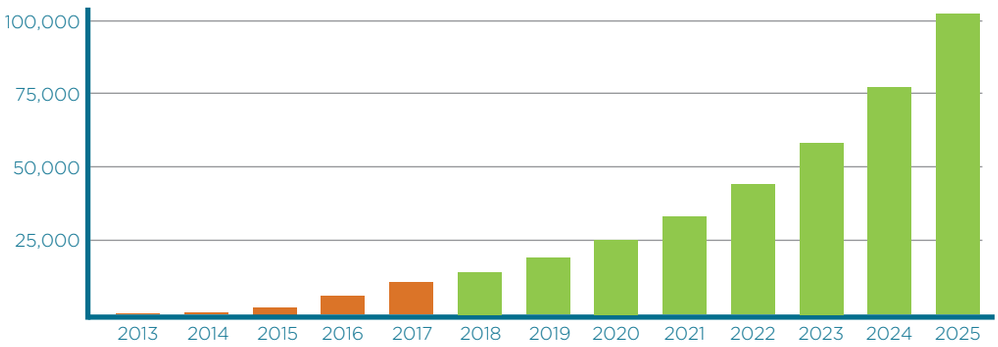
"Vermont is widely recognized as an international leader in the use of modern wood heating systems in the residential, commercial, and institutional markets. Through a combination of weatherization, beneficial electrification, and expanded use of modern wood heating, we can reach our thermal goals!"

The Biomass Energy Resource Center (BERC) at VEIC has a long-lived reputation as a source of independent and impartial information and services regarding the advancement of modern wood heating as an effective strategy to reduce dependence on fossil heating fuels, strengthen local economies, and encourage the local use of wood harvested from well-managed forests.

Are we moving fast enough on fuel switching?

In order to achieve the numbers set forth in the 2025 "Path to Paris" analysis, we would need to convert about a third of Vermont's 335,224 housing units[1] from fossil fuels to renewable heat by 2025. How are we doing so far?

Heat pump systems in Vermont

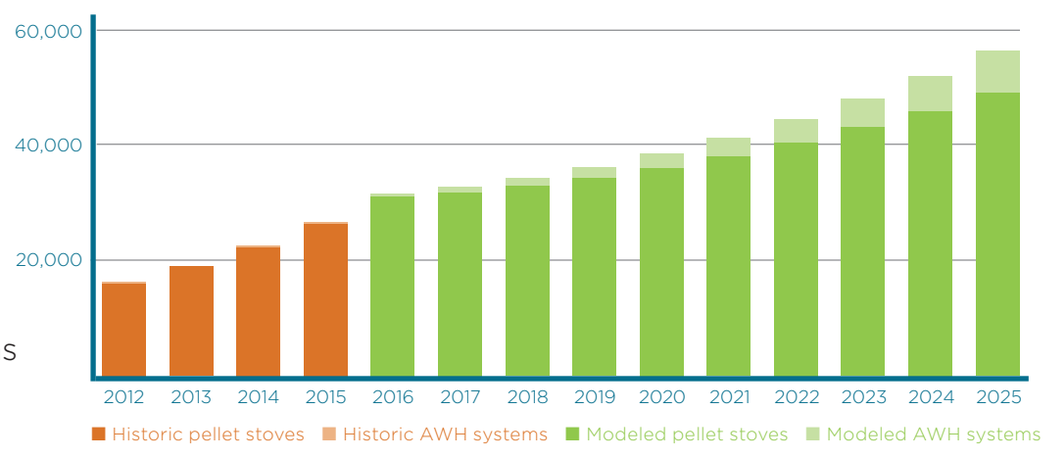


The **Path to Paris** models 90,000 additional heat pump systems by 2025. Historically, adoption has more than doubled each year, which is a good sign! Going forward, adoption would need to increase by 37% each year to reach 90,000 systems by 2025.[2]

Despite being incentivized statewide for only a few years, heat pumps have seen impressive adoption trends. It's a slightly different story for advanced wood heat.

Historically, nearly all of our growth in advanced wood heat has come from pellet stoves. Going forward, the Biomass Energy Resource Center (BERC) has modeled moderate growth in pellet stoves and significantly more growth in automated advanced wood heat systems to meet our state goals.[3]

Advanced wood heat (AWH) systems in Vermont



1. United States Census Bureau, 2017. **2.** Historic heat pump data extrapolated from Efficiency Vermont rebate data and assumes rebates capture 75% of statewide installations. **3.** Historic and modeled data from the Biomass Energy Resource Center (BERC).

MEMBER PROFILE: **Maura Adams**

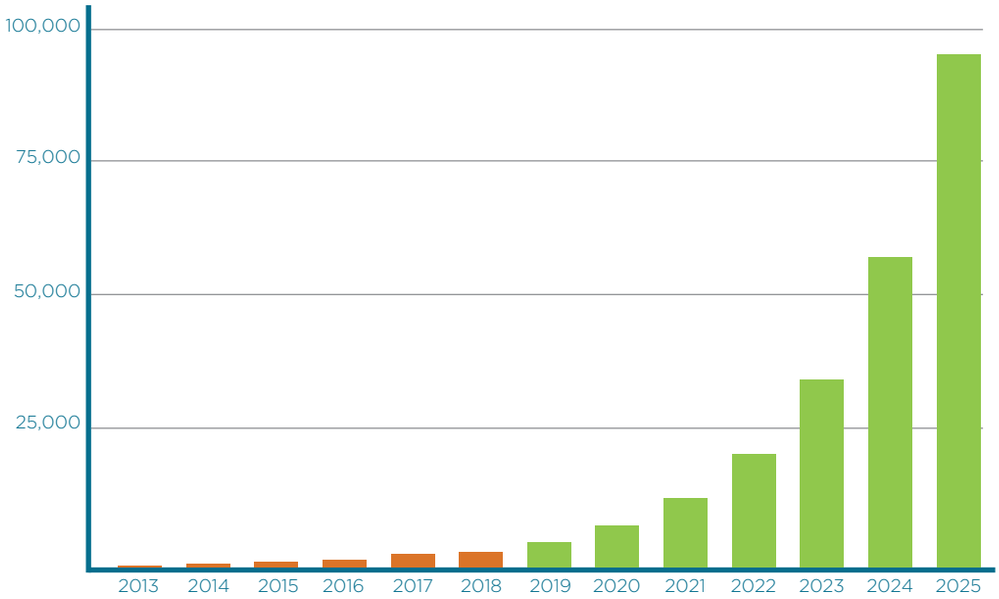
Program Director, Northern Forest Center

"Every building that converts to Automated Wood Heat supports our forest economy and reduces greenhouse gases. The 163 boilers we've helped install have generated $3.5 million for the region, and that impact grows larger every year."

The Northern Forest Center is a regional innovation and investment partner creating rural vibrancy by connecting people, economy, and the forested landscape. The Center builds public awareness about Automated Wood Heat as an alternative to fossil fuels and advocates for supportive public policies and fuel-switching incentives.

Are we moving fast enough on electric vehicles?

Electric vehicles in Vermont



While electric vehicle adoption has been growing, in order to reach the Path to Paris model of **90,000 additional vehicles by 2025**, adoption would need to grow about 65% each year, significantly faster than it has been to date.[1]

For context, an estimated 264,000 new vehicles will be sold in VT by 2025, which means EVs would have to make up a third of those vehicle sales.[2]

Factors in electric vehicle progress

BRAKES	ACCELERATORS
Manufacturers (Tesla, Chevrolet) hitting phase-out of federal tax credit incentive	New manufacturers getting involved in electrification
Automakers discontinuing some popular electric models	New models with all-wheel drive and in larger sizes
No Vermont state incentives available	Utility incentives through programs related to Vermont's Renewable Energy Standard
Auto dealers and salespersons often lack experience and training to sell electrification	Upfront cost decreases

1. Historic data from Drive Electric Vermont. Modeled data assumes 50% All-Electric Vehicles (AEVs) and 50% Plug-in Hybrid Electric Vehicles (PHEVs) in 2025.
2. Extrapolated from Auto Alliance Vermont State Facts.

MEMBER PROFILE: **Paul Costello**

Executive Director, Vermont Council on Rural Development (VCRD)

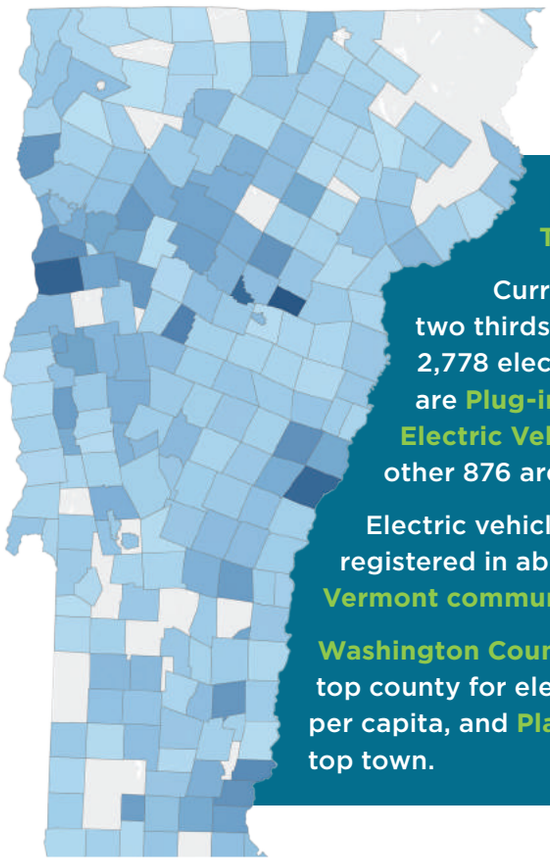
"VCRD works with communities throughout Vermont to help them set and implement goals for the future. The Climate Economy Model Community program engages local residents in identifying priority projects to advance clean energy and economic progress. VCRD also leads the Climate Economy Action Team and the Working Lands Coalition to further growth in these sectors of our rural economy."

The Vermont Council on Rural Development is a federally-recognized "State Rural Development Council" charged as a nonpartisan facilitator of local and statewide policy projects to galvanize community and economic development in service to the people of rural Vermont.

Electric vehicles and charging stations are spreading

As a key technology needed to reach our Paris goals, the adoption of electric vehicles is critically important. These maps show the towns where electric vehicles are currently registered and where you can plug those vehicles in at public charging stations.

Electric vehicles



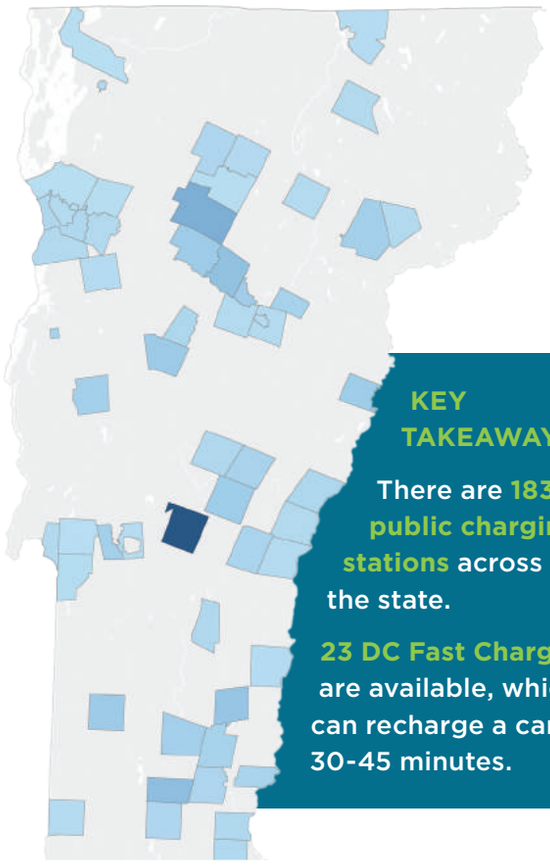
KEY TAKEAWAYS[1]

Currently over two thirds (1,912) of the 2,778 electric vehicles are **Plug-in Hybrid Electric Vehicles.** The other 876 are All-Electric.

Electric vehicles are registered in about **85% of Vermont communities.**

Washington County is the top county for electric vehicles per capita, and **Plainfield** is the top town.

Charging stations



KEY TAKEAWAYS

There are **183 public charging stations** across the state.

23 DC Fast Chargers are available, which can recharge a car in 30-45 minutes.

Learn more about our energy progress on the Vermont Energy Dashboard.
vtenergydashboard.org

1. October 2018 EV Registration Updates, Drive Electric Vermont.

MEMBER PROFILE: **Kate McCarthy**

Sustainable Communities Program Director, Vermont Natural Resources Council Transportation for Vermonters

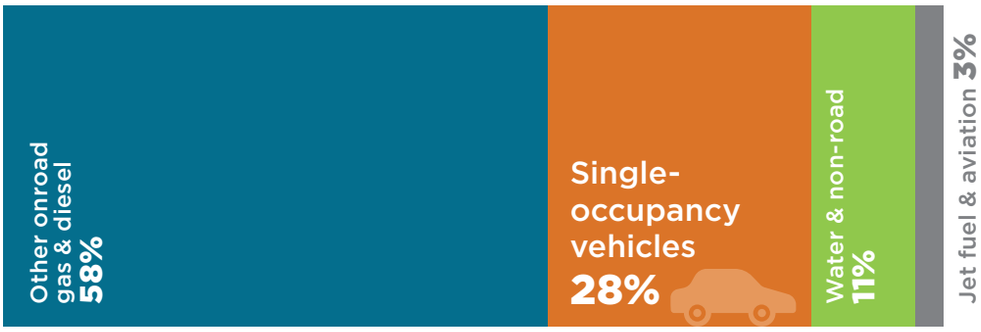
"Investing in our historic villages and downtowns is a win-win approach: not only do we get more opportunities to save money and energy by driving less, but smart growth allows us to increase housing choice and strengthen the places we love."

VNRC protects and restores our natural resources and communities by advocating in the State House, conducting research, and building and coordinating coalitions. One such cross-sector coalition, Transportation for Vermonters, is committed to increasing the affordability, access, and sustainability of Vermont's transportation system.

Transit: It takes, and makes, a village

Single occupancy vehicle commutes[1] alone emit approximately 1.214 MMTCO2e annually.

Vermont transportation emissions by type[2]



Doubling transit to cut single occupancy work commutes in half by 2025 would result in reductions of .158 MMTCO2e in direct GHG reductions.

Studies have shown that improving and expanding transit — bus and rail — results in more efficient land use patterns, with development centered around transit hubs. This reduces vehicle miles traveled and greenhouse gas emissions in excess of the direct benefits of increased transit by encouraging walking, biking, and fewer miles traveled by community members.

An ICF International study found that these secondary impacts of increasing transit could result in up to **three times as much reduction in carbon emissions** as the primary impacts.[3]

1. American Community Survey. Note: This figure only includes commutes (trips to and from work). No official data exists for total single occupancy vehicle trips. **2.** 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources. **3.** "The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction," ICF International, February 2008.

MEMBER PROFILE: **Nick Charyk**

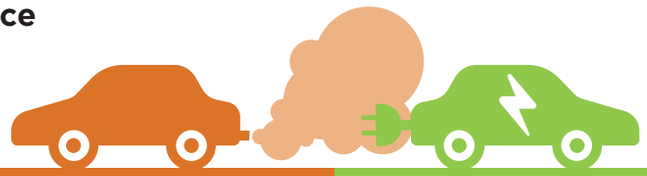
Communication and Public Affairs Manager, AllEarth Renewables

"Creating a community passenger rail network is something we can do now to begin reducing emissions from the transportation sector. The Budd Cars are cost-effective, safe, and ready to roll here in Vermont."

AllEarth Renewables has invested in a fleet of a dozen self-propelled, stainless steel Budd rail diesel cars, intended for community passenger rail service here in Vermont. AllEarth's vision is the creation of a passenger rail network connecting Vermont's cities and towns through an integrated public transportation system.

Going electric saves money…

Looking at the total operating cost, the American Automobile Association found that an all-electric vehicle cost 11.28 cents per mile, compared to a medium sedan at 17.76 cents per mile. That means **gas vehicle drivers spend nearly $10,000 more on operations and maintenance over 150,000 miles.**[1]



	GAS VEHICLE	ELECTRIC VEHICLE
Fuel	$2.74/gallon[2]	$1.50/gallon equivalent[3]
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 just a few possible maintenance costs, the Union of Concerned Scientists found that an all-electric vehicle would save at least $1,500 on maintenance over 150,000 miles.[4]

…and reduces health costs

A 2016 study from the American Lung Association found that Vermont stands to save **$313 million in total health and climate costs** by transitioning to a majority of electric vehicles by 2050.[5]

1. Your Driving Costs, American Automobile Association, 2018. **2.** Energy Information Administration, 2018 average Regular gas price in New England. **3.** Drive Electric Vermont. Note: does not account for rate design or other programs that may reduce charging costs. **4.** Adapted to Vermont from Going from Pump to Plug, Union of Concerned Scientists, 2017. Compares the cost of the manufacturer's recommended services for a Chevrolet Bolt EV and a Chevrolet Sonic over 150,000 miles. **5.** Clean Air Future, American Lung Association. ALA assumes that meeting our Zero Emission Vehicle targets would result in 65% of the fleet being zero emission vehicles in 2050.

MEMBER PROFILE: **Jen Green**

Sustainability Officer, Burlington Electric Department, City of Burlington

"As part of Mayor Miro Weinberger's 'net zero energy city' initiative, Burlington Electric is focused on renewable transportation options for Burlington, including an e-bike rebate program and lending library, innovative financing options, bringing e-buses to Burlington, and electric vehicle rebates and charging rates."

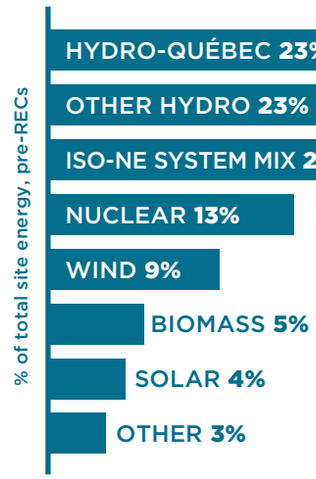
In 2014, Burlington became the first city in the country to source 100% of its power from renewable generation, including from biomass, hydro, wind, and solar. Served by the Burlington Electric Department, Burlington is now working to transition to net zero energy by 2030.

Renewable electricity increases

Table 1: Electricity generation sources for Vermont[1]

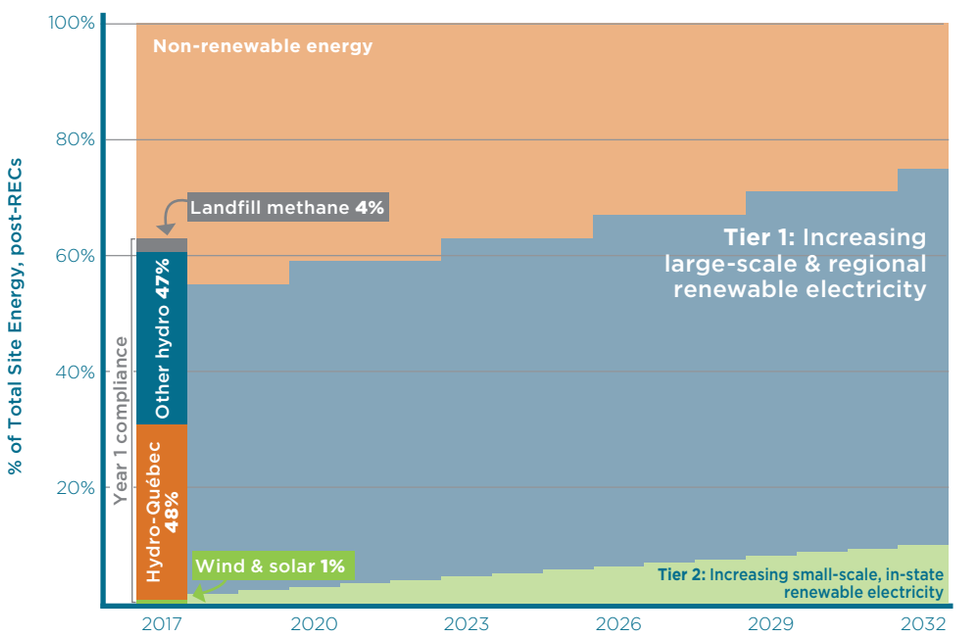
When it comes to electricity, we can look at what is generated and consumed (Table 1), and also at Vermont's Renewable Energy Standard (Table 2).

While we generate energy from renewable sources in Vermont, the high-value Renewable Energy Credits for many of those resources are sold, which helps keep electric prices low for Vermonters.



In 2017, Vermont utilities sold high-value solar, wind, and biomass RECs, and bought lower cost hydro RECs to lower electric rates and fulfill the first tier of the Renewable Energy Standard.

Table 2: Vermont Renewable Energy Standard[1]



In 2017, the first year of the Renewable Energy Standard, utilities exceeded the 55% Tier 1 requirement, achieving 63% renewable electricity for VT. **Nearly 100% of those RECs came from hydropower and the Hydro-Québec System Mix.**

Utilities met the requirement of 1% small scale renewable electric (Tier 2).

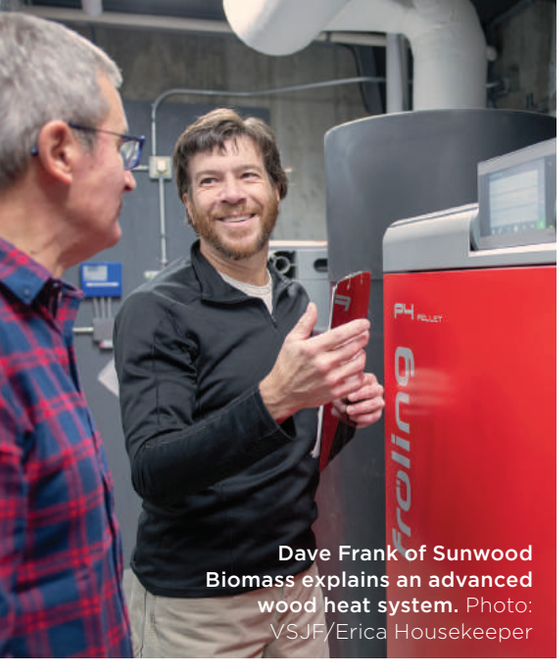
1. Department of Public Service, 2017 generation and REC data.

MEMBER PROFILE: **Tom Dunn**

President and CEO, VELCO (Vermont Electric Power Company)

"VELCO's vision is to help create a sustainable Vermont through our people, assets, relationships, and operating model. As a member of the Climate Pledge Coalition, we have created an ambitious action plan for reducing our carbon footprint."

VELCO works with Vermont's 17 local utilities and the New England regional grid operator to ensure electric reliability in Vermont. They have installed a solar array and EV charging stations on campus, and have provided employee incentives for acquiring solar arrays, EVs, and heat pumps.



Dave Frank of Sunwood Biomass explains an advanced wood heat system. Photo: VSJF/Erica Housekeeper

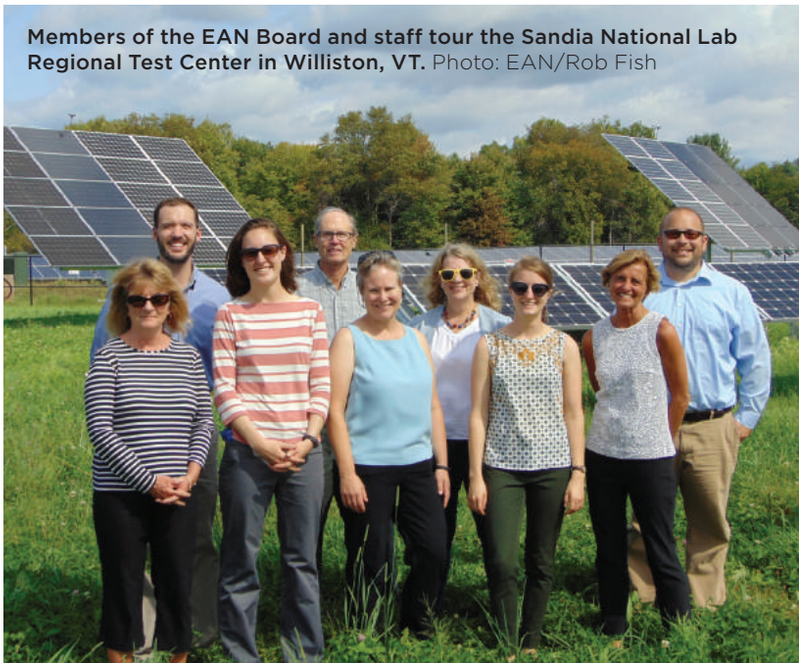
St. Michael's College Sun CARnival Demo Event. Photo: Drive Electric Vermont

TOGETHER, WE CAN DO THIS

AllEarth's Budd Car pulls into Montpelier, VT on a test run. Photo: AllEarth Rail/Brooke Bauer

Grassroots Solar customers Heine and Darlene Nowak stand by their new battery system. Photo: Grassroots Solar

Vermonters sign up to learn more about Button Up at the Montpelier Farmers Market. Photo: Button Up Vermont/Paul Markowitz

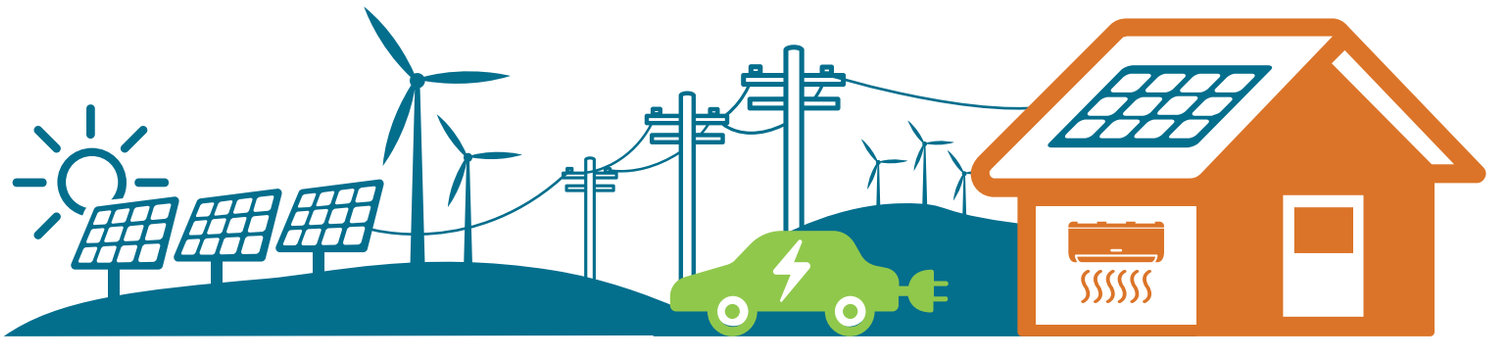


Members of the EAN Board and staff tour the Sandia National Lab Regional Test Center in Williston, VT. Photo: EAN/Rob Fish

Creating a smart grid to accelerate Vermont's renewable progress

Smart grid investments allow **communications between devices that produce, store, and use electricity,** which will reduce carbon by maximizing adoption of local renewable distributed generation, energy storage, and other smart electric devices. These technologies will enhance grid performance, build resiliency in a changing climate, and reduce carbon emissions.

Every Vermonter stands to benefit from smart grid investments.



What are smart grid investments?

Demand response programs allow utilities and customers to shift electric load away from peak demand. In 2017, there were over **15,000** Green Mountain Power customers enrolled in a demand response program.[1]

Energy storage, like battery systems, help store excess generated electricity and send it back to the grid as needed.

Strategically electrifying heating and transportation loads can help shift those new electric loads to times of day when there is excess generation from solar and wind power.

A recent analysis from Energy Futures Group found that every ratepayer stands to benefit from strategic electrification.[2]

All of these investments can save ratepayer dollars, reduce strain on the grid, and increase the resiliency of the grid in the face of more damaging storms.

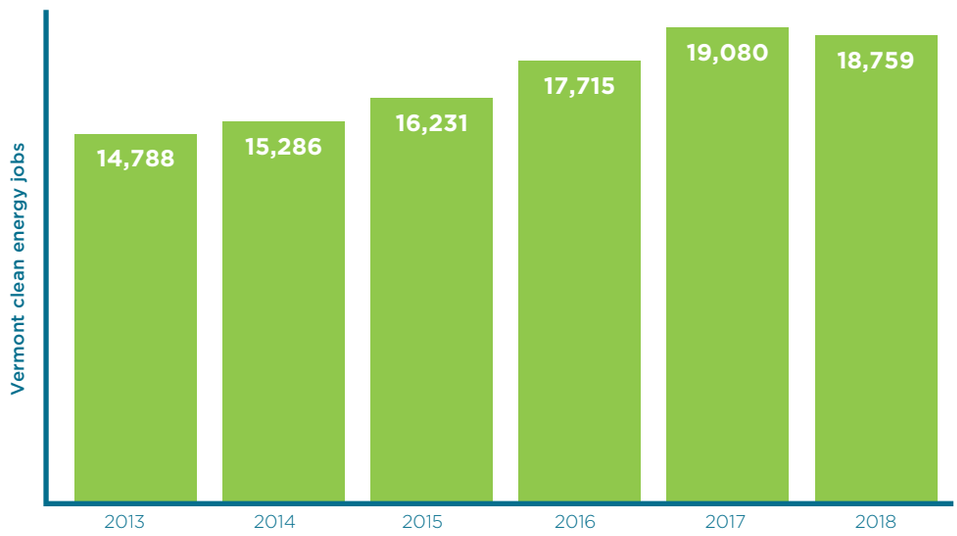
1. Form EIA-861, Energy Information Administration, 2017. Only Green Mountain Power is required to report Demand Response activities.
2. "'Tier 3' — Statewide Total Energy Program (STEP) Beyond Fossil Fuels," Energy Futures Group.

MEMBER PROFILE: **Scott Johnstone**
CEO, Packetized Energy

"We are proud to support our utility partners with innovative solutions to reach Vermont's ambitious 2025 milestones while keeping energy affordable for Vermonters."

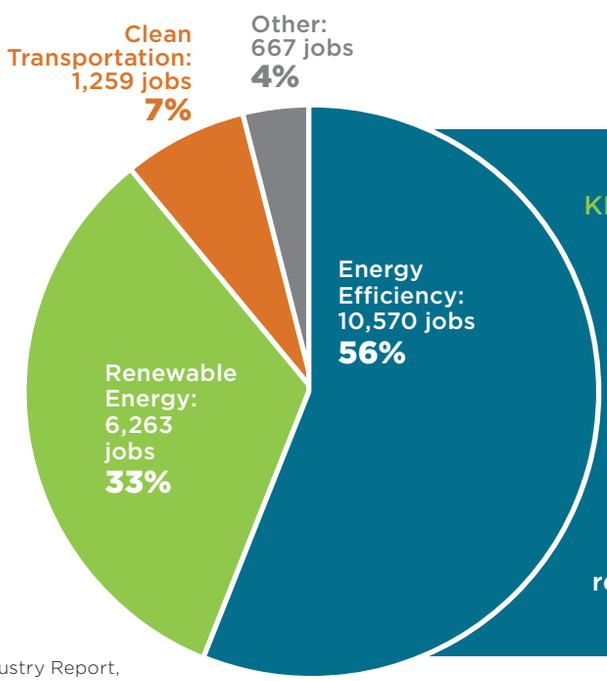
Packetized Energy is a Burlington-based startup that creates virtual batteries from devices like water heaters and electric vehicle chargers to provide balancing services to utilities aiming to keep costs low while incorporating more renewable energy. The team is conducting pilots with VEC and GMP and just launched a 5-year project with Burlington Electric Department.

Vermont clean energy jobs



For the first time since tracking began in 2013, jobs in clean energy in Vermont decreased (-1.7%) in 2017. However, clean energy jobs still make up 6% of total statewide jobs in Vermont, a higher share than any other state.[1]

Vermont share of clean energy jobs by sub-sector



KEY TAKEAWAYS[1]

With 18,759 jobs, Vermont boasts the largest share of clean energy jobs in the country.

The median income for these jobs is $26.71, higher than the median income for the state.

The majority of these jobs are in energy efficiency (10,570), followed by renewable energy (6,263).

1. Vermont 2018 Clean Energy Industry Report, Clean Energy Development Fund, VT Department of Public Service.

MEMBER PROFILE: **Rebecca Towne**

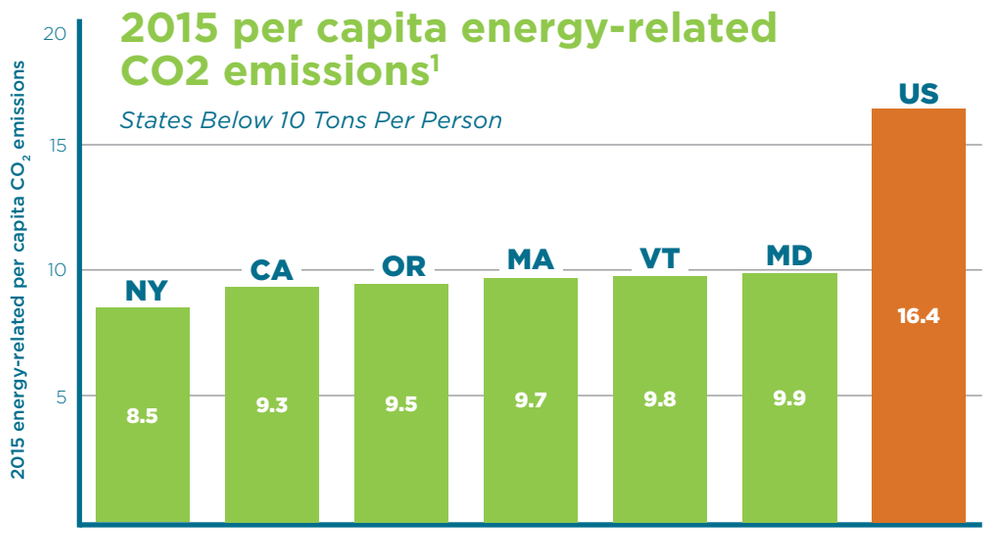
Chief Executive Officer, Vermont Electric Cooperative

"We are committed to expanding electrification of cooling, heating, and transportation systems as we continue to move towards a low-carbon and clean energy supply. We believe that by pursuing innovation and creative solutions we can ensure an even brighter and more resilient energy future that benefits our members and the environment."

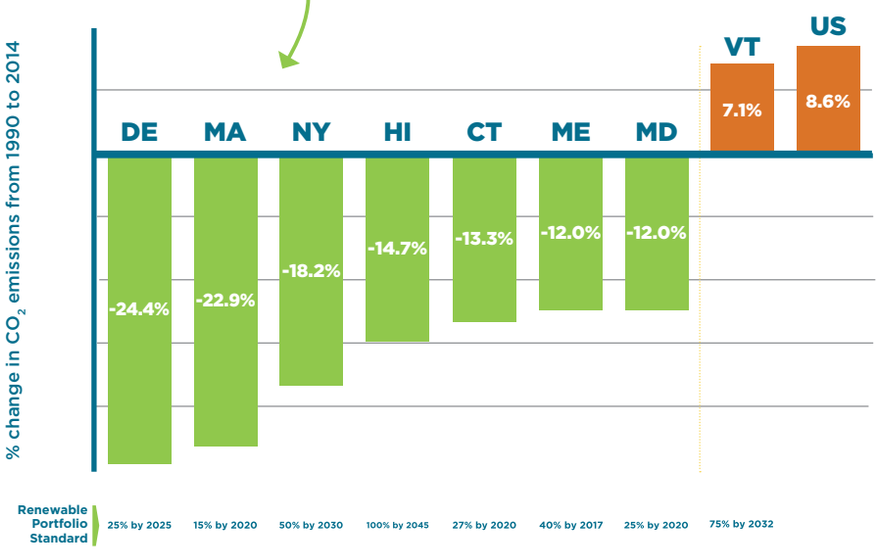
At Vermont Electric Cooperative, our core mission is to provide safe, reliable and cost effective service to our member-owners. VEC is a nonprofit, member-owned cooperative with over 32,000 members in northern Vermont.

VT has low per-capita carbon emissions, but those emissions are on the rise

The carbon (CO2) emissions of 23 states declined below their 1990 levels as of 2014. Seven states achieved double-digit CO2 emissions declines in that period — but not Vermont.



States with Double-Digit CO2 Emission Declines, 1990-2014[2]



KEY TAKEAWAYS

Vermont has relatively low per capita carbon emissions, but those emissions have increased significantly since 1990.

Just three states, California, New York, and Massachusetts, have per capita energy CO2 emissions below 10 tons/person and have also achieved carbon emission declines below 1990 levels, as of 2014.

1. Energy Information Administration. Note: Due to data constraints, this comparison only looks at carbon emissions, not all GHG emissions. Also, EIA does not fully count carbon emissions created by Vermont's electric use. Vermont's per capita GHG emissions were around 16 tons of CO2e in 2015, and the US was at 20.5. In 1990, only two states, Vermont and Rhode Island, had per capita carbon emissions below 10 tons. **2.** Environmental Protection Agency. Note: All states listed except Hawaii are members of the Regional Greenhouse Gas Initiative.

MEMBER PROFILE: **Heather Furman**

Vermont State Director, The Nature Conservancy

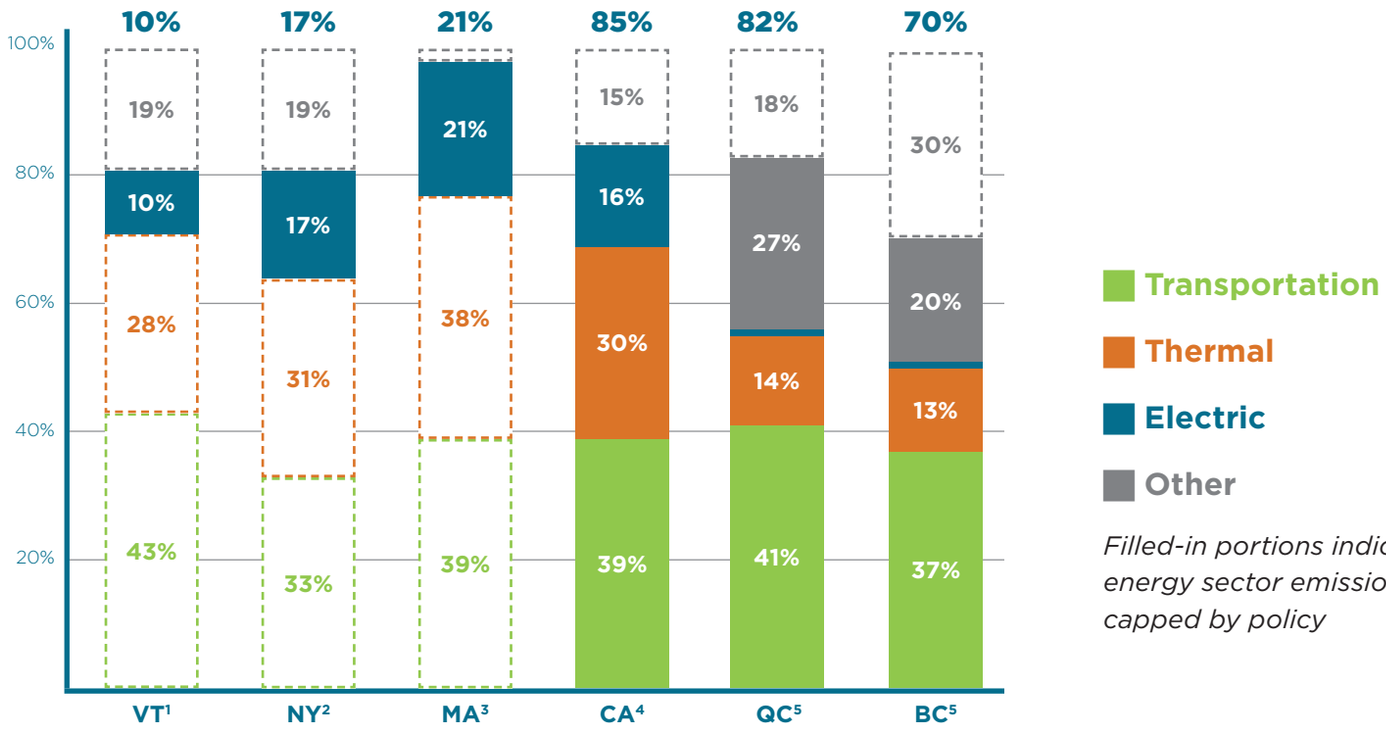
"The ways we protect, restore, and manage our land and water has the potential to reduce global emissions by 11.3B tons/year by 2030, offering 37% of the emissions reductions needed to hold global warming below 2 degrees Celsius. That's huge. If we're serious about tackling climate change, then we have to get serious about investing in nature."

Guided by science, The Nature Conservancy works locally and globally on innovative solutions to our world's toughest challenges so that people and nature can thrive.

Policies designed to reduce emissions

As of the end of 2018, Vermont is one of ten US states and two Canadian provinces that participate in a decarbonization program. But the Regional Greenhouse Gas Initiative (RGGI) that Vermont participates in currently only covers a small percentage of our total emissions. See how we stack up.

Percent of emissions covered by statewide decarbonization program



Vermont, New York, and Massachusetts participate in RGGI. California and Québec are members of the Western Climate Initiative (WCI), a cap and invest program. British Columbia has a province-wide carbon fee.

1. 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources **2.** SOURCE: New York State Greenhouse Gas Inventory: 1990-2015, NYSERDA **3.** MA GHG Emission Trends, Executive Office of Energy and Environmental Affairs **4**. California Greenhouse Gas Emissions Inventory - 2018 Edition, California Air Resources Board **5.** Canada's greenhouse gas inventory, Environment and Climate Change Canada.

MEMBER PROFILE: **Rick Weston**

Principal and Director, Policy, Regulatory Assistance Project

"RAP works with policymakers and regulators here in the US and around the world to help them navigate the complexities of the transition to a low-cost, low-carbon energy future. Reliable, clean production and efficient use of electricity are at the heart of that future, and there are many ways of getting there. As trusted advisors to decision-makers, we provide pragmatic solutions crafted to suit the particular needs of their jurisdictions."

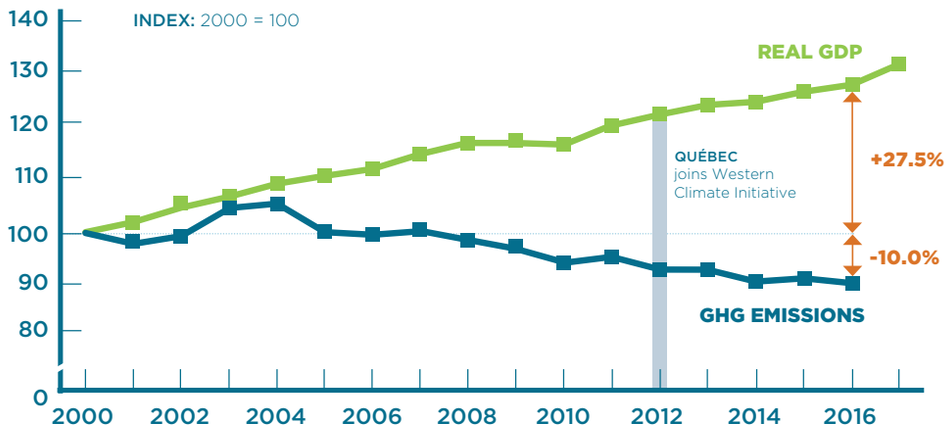
The Regulatory Assistance Project (RAP) is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Decoupling emissions & economic growth

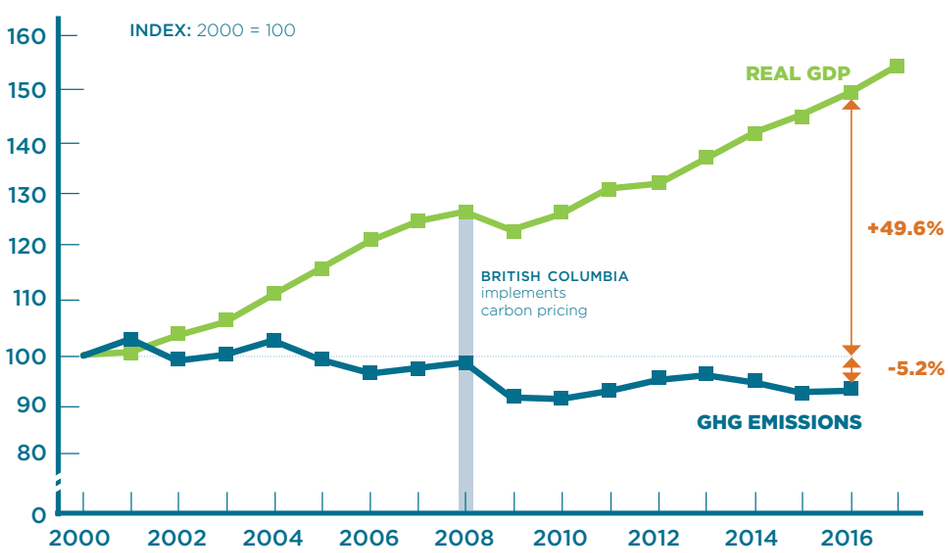
Emissions were once tied to economic growth. That is no longer the case across the globe. Can Vermont follow suit?

Between 2000-2014, at least 35 countries including the U.S. saw their economies grow while reducing carbon emissions.[1]

Québec has decoupled emissions and economic growth (2000-2017)[2]



British Columbia has decoupled emissions and economic growth (2000-2017)[2]



Our neighbors in Québec, British Columbia, and California that have instituted economy wide carbon policies have seen dramatic economic growth while also reducing emissions below 2000 levels — demonstrating that their policy implementation has not negatively impacted economic growth.

1. "The 35 countries cutting the link between economic growth and emissions,"Carbon Brief. **2.** Emissions: Environment and Climate Change Canada, GHG Emissions by Province and Canadian Economic Sector, 1990-2016; GDP: Statistics Canada, NWT Bureau of Statistics.

MEMBER PROFILE: **April Salas**

Executive Director, Revers Center for Energy, Tuck School of Business at Dartmouth College

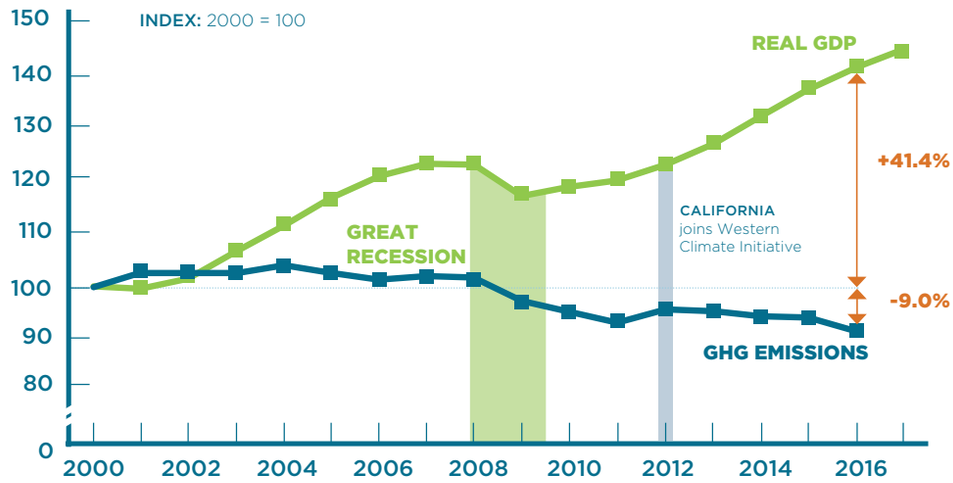
"Dartmouth has embraced a future that includes improving global sustainability and overcoming the challenges of climate change. Open discourse, robust networks, and community action facilitate investments that produce the greatest possible impact, and enable us to build a sustainable and replicable model for positive change."

Tuck is committed to educating wise leaders to better the world of business. The Center helps build pathways of learning and connection, with a mission to inspire and shape tomorrow's energy leaders while engaging today's energy community.

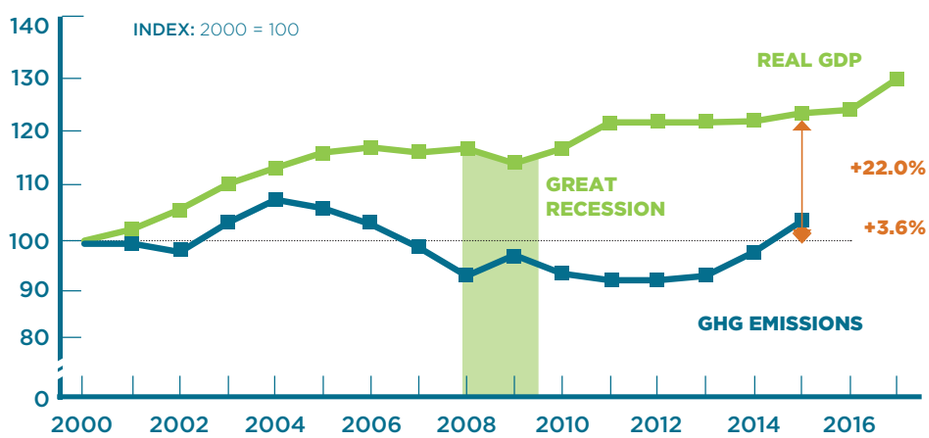
Decoupling emissions & economic growth

In the US, 33 states decoupled economic growth and carbon emissions between 2000-2014, including Vermont.[2] But the latest data show that Vermont's emissions are back above 2000 levels.

California has decoupled emissions and economic growth (2000-2017)[1]



Has Vermont decoupled emissions and economic growth? (2000–2017)[3]



Vermont's GHG Emissions and GDP dipped between 2007-2009 during the Great Recession. For a few years during the economic recovery, Vermont's GHG emissions remained flat, but recent years have brought a significant increase.

1. Emissions: California Air Resources Board Greenhouse Gas Inventory, GDP: Federal Reserve Economic Data. **2.** "Growth, carbon, and Trump: States are "decoupling" economic growth from emissions growth," Brookings Institute. **3.** Emissions: 2018 Greenhouse Gas Emissions Inventory Brief (1990-2015), VT Agency of Natural Resources. GDP: Federal Reserve Economic Data.

MEMBER PROFILE: **Justin Johnson**

Head, Global Strategic Markets, MMR, LLC

"Vermont can't solve the carbon problem alone — and it doesn't have to! Forty-six nations and 24 sub-national jurisdictions, accounting for 20% of the world's emissions, have a price on carbon. More than 1,400 companies, including 100 Fortune 500 companies have internal carbon pricing. We can work together to create jobs and opportunity for the future."

MMR, LLC is a Vermont government relations firm with a dynamic practice and a record of delivering results on a range of policy issues.

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	**2,788**	**45,000**	93,000	269,500	Total number of electric vehicles and plug-In hybrids
			0.72%	**12%**	24%	70%	% of light-duty vehicle fleet (LVF)
Light-Duty Vehicle Fleet Efficiency (LVF) (combustion engines only)	Fleet MPG	20.3	**22.2**	**24.1**	24.1	32.4	
		0%	**9%**	**19%**	19%	50%	% fuel efficiency increase of LVF combustion engine fleet (over 2010)
Commerical-Industrial Fleet Efficiency	Fleet MPG	6	**N/A**	**6.9**	6.9	9	
		0%	**N/A**	**15%**	15%	50%	% fuel efficiency increase for commerical/industrial fleet (over 2010)
Biofuels[4]	Million Gallons	28.7	**30.9**	**40**	*	211	
		5%	**5.5%**	**12%**	*	90%	% of total fuel use for combustion engine fleet (LVF, commercial, industrial). Aviation not included.
Single Occupancy Vehicle Commute Reduction	% Commute Trips	79.2%	**80.7%**	**67%**	64%	50%	% of work commute trips in single occupancy vehicle
Public Transit Ridership Increase	Annual Riders (millions)	4.58	**4.71**	**8.7**	8.7	17.4	Total annual public transit ridership
			3%	**90%**	90%	280%	% increase/decrease from baseline
Total Transportation Energy	TBTU	50.6	**50.5**	**39.1**	38.5	31.5	Total energy used for transportation
Renewable Energy Share	%	4.5%	**4.7%**	**10%**	15%	85%	% of total transportation energy from renewable resources
THERMAL							
Building Efficiency Savings	Trillion BTU (TBTU)	0.04	**1.80**	**4.12**	4.50	11.30	Cumulative energy savings from building efficiency
		0%	**4%**	**10%**	11%	30%	% increase in energy savings for building heating/ cooling over 2010
Wood Heat	TBTU	10.2	**9.2**	**10.26**	10.26	9.0	Includes cordwood, pellets, and woodchips
		25%	**21%**	**28%**	28%	35%	% of heating demand met by biomass (residential & commercial)
Biofuels	TBTU	0	**N/A**	**0.62**	*	4.0	
		0%	**N/A**	**2%**	*	15%	% of heating demand met by liquid biofuels (residential & commercial)
Heat Pumps	Total # of heat pump systems	0	**10,700**	**35,000**	100,700	237,000	
		0%	**1.2%**	**4.5%**	15.5%	43%	% reduction in fossil fuel heating due to heat pumps (residential & commercial)

Total Thermal Heat Load	TBTU	41.2	**42.8**	**37.1**	30.8	26.6	VT residential & commercial heating/cooling load
		0%	**4%**	**-10%**	-25%	-30%	% energy reduction/increase for building heat over 2010
Total Industrial Heat & Process	TBTU	8.4	**6.1**	**8.5**	8.5	6.5	Thermal energy for industrial heat & manufacturing processes
Total Thermal	TBTU	49.6	**48.9**	**45.6**	39.3	33.1	Total thermal energy including industrial process
Renewable Energy Share	%	22%	**20%**	**27%**	35%	93%	% of total thermal energy from renewable resources
ELECTRIC							
Wind[5]	Megawatts	7.4	**241**	**350**	441	650	Cumulative MW capacity from in-state & regional wind
		0.3%	**9%**	**11%**	19%	21%	% of total electric power generation (MWh)
Solar[5]	Megawatts	11	**345**	**550**	744	1,500	Cumulative MW capacity from solar
		0.2%	**4%**	**10%**	16%	24%	% of total electric power generation (MWh)
Hydro (VT small)	Megawatts	190	**200**	**215**	*	225	Cumulative MW capacity from small-scale hydro
		10%	**12%**	**13%**	*	9%	% of total electric power generation (MWh)
Hydro-Québec (import)	Megawatts	400	**218**	**218**	*	600	Existing Hydro-Québec contract (2012) remains unchanged until 2030
		31%	**22%**	**20%**	*	40%	% of total electric power generation (MWh)
Methane (Farm and Landfill Methane)	Megawatts	3	**18**	**22**	33	45	Cumulative MW capacity from farm and landfill methane
		0.3%	**2.0%**	**2.1%**	3%	3.5%	% of total electric power generation
Total Electric Generation[6]	Gigawatt Hours	5,665	**5,416**	**6,680**	5,958	8,250	Total electric retail sales
Electric Renewable Share[7]	%	N/A	**63%**	**67%**	67%	97%	% of total site electricity from renewable resources
Total Electric Source Energy[8]	TBTU	44.4	**33.5**	**30.0**	30.0	27.0	Source energy for electrical generation which includes fossil fuel combustion losses
Total Energy Demand	TBTU	145	**129**	**115**	108	92	Total source energy used in all sectors
Total Renewable Energy %[9]	%	15%	**19%**	**25%**	30%	90%	% of total energy from renewable resources

* EAN's Path to Paris model shows a greater adoption of renewable energy technology than the model to reach 25% by 2025. Both are included here to demonstrate the difference. The Path to Paris model only includes the top ten measures to reach the Paris Agreement commitment, but includes a 20% buffer, which would allow for increased adoption of other measures.

1. Transportation data from the Energy Information Administration (EIA) (2016), the UVM Transportation Research Center (2016 and 2017) and Drive Electric Vermont (Oct 2018); Thermal data from EIA (2016), Efficiency Vermont (2017), Vermont Gas (2017), and the Department of Public Service (DPS) (2017); Electric data from the Dept of Public Service (2017) and Certificates of Public Good (ePUC December 2018). N/A indicates incomplete or unavailable data.

2. Projections are those of EAN, building upon the 2016 Comprehensive Energy Plan's 25% by 2025 milestone and 90% by 2050 goal.

3. Assumes a 50% split between EVs and PHEVs by 2025.

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

5. Permitted wind and solar as of Dec 2018, including net metering, the Standard Offer, and SPEED projects.

6. VT Utility Retail Sales. 2050 GWH total based on VEIC Solar Pathways study.

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

8. Source Energy includes conversion losses as calculated by the VT PSD. Solar, wind, and hydro have no fuel conversion losses.

9. Total Renewable Energy % is based on EAN Source Energy calculation for transporation, thermal, and electricity. Does not account for REC transactions.

VT statutory energy & emissions targets, 2017 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).	90%	2050	19.4%	→
	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% 145 trillion BTU (2016)[1]	↓
	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	10%	N/A[2]
	30 V.S.A. 8002 (2015): Statewide Total Energy Program (STEP)/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 2013	1.7%[3]	N/A[4]
	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 (RPC) 11 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	+16% (2015)[5]	↓
	CEP (2016): Reduce greenhouse gas emissions by 40% below 1990 by 2030.	-40%	2030	+16% (2015)[5]	↓
	Paris Agreement: Reduce GHG emissions by 26%-28% below 2005 levels.	26-28%	2025	-2% (2015)[5]	↓
TRANSPORTATION	**CEP (2016):** Reduce total transportation energy use by 20% from 2015 levels by 2025.	-20% 39.1 trillion BTU	2025	-2% 59.8 trillion BTU	↓
	CEP (2016): Reduce transportation-emitted GHGs by 30% from 1990 levels by 2025.	-30% 3.22 MMTCO2e	2025	+34% 4.33 MMTCO2e (2015)	↓
	CEP (2016): Hold vehicle miles traveled (VMT) per capita to 2011 levels.	11,402	2030	11,790 (2016)[6]	↓
	CEP (2016): Reduce share of single- occupancy vehicle commute trips by 20% of 2011 levels (79.2%).	-20%	2030	+1.4%, 81.4% (2017)	↓
	CEP (2016): Double the share of bicycle and pedestrian commute trips to 15.6%	15.6%	2030	7.0% (2015)	↓
	CEP (2016): Increase public transit ridership by 110% to 8.7 million annual trips	8.7M	2030	4.69M (2017)	↓
	CEP (2016): Quadruple Vermont-based passenger rail trips from 2011 levels (91,942) to 400,000 trips annually.	400,000	2030	94,157 (2017)	↓
	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	0.5% (2018)	↓
	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	25,409 (2017)[7]	↓
	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	23% (2017)[7]	↓
	CEP (2016): Install 35,000 cold climate heat pump systems by 2025.	35,000	2025	10,694[8]	→
	CEP (2016): Increase wood's share of building heat to 35% by 2030.	35%	2030	21% (2014)9	N/A[2]
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	63%[10]	N/A[4]
	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	1.06%[10]	
	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	93 MW contracts awarded 64 MW projects commissioned[11]	→

1. Energy Information Administration, calculated from total energy consumed (2016). **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.** The latest data, from 2017, was the first full year of accounting for the Renewable Energy Standard, so the trend is unclear so far. **5.** 2018 ANR Brief —Vermont Greenhouse Gas Emissions Inventory Update (1990-2015). **6.** All Transportation data (other than Emissions) from the UVM Transportation Research Center. **7.** Department of Public Service. 2018 Building Energy Report. **8.** Efficiency Vermont (2017). Assumes rebates cover 75% of heat pumps sold. **9.** Biomass Energy Resource Center, VEIC, "Wood Heating in Vermont: A Baseline Assessment," 2016. **10**. Department of Public Service. Utilities were obligated to retire RECs equivalent to 55% of retail sales in 2017, the first full year of REC compliance. **11**. Department of Public Service.

From EAN's Executive Director & Board Chair

In 2018, EAN expanded its role as Vermont's trusted, go-to resource for total energy tracking and analysis. Through our Annual Progress Report and the Vermont Energy Dashboard, we provided key resources for EAN members, policymakers, and community leaders. We ensured the dissemination of important data and analysis through presentations and webinars to local and state leaders as well as by engaging in the Vermont Climate Action Commission. Together these efforts increased understanding of Vermont's total energy and emissions reduction commitments, what it will take to meet them, and the benefits that Vermonters stand to gain when we do so.

Building on that work, this Annual Progress Report—our most comprehensive yet—summarizes where we stand as of 2018 relative to the State of Vermont's renewable energy and greenhouse gas emissions reduction commitments. EAN's goals are Vermont's goals, and the measure of our success as a Network is the extent to which we help Vermonters reap the benefits of transitioning to an efficient and renewable energy future.

Today, our energy progress is a tale of two Vermonts. On the one hand, thanks mostly to the increasing renewability of our electric sector, Vermont was 19% renewable as of 2018, with a good chance of meeting the first milestone of our Comprehensive Energy Plan: 25% renewable by 2025. On the other hand, we are falling far short of our greenhouse gas emissions reduction commitments.

The great challenge and opportunity for Vermont over the next six years is to preserve and continue the progress we have made in the electric sector while also moving beyond fossil fuels for our transportation and heating needs. We will only achieve the scale and pace of progress we need on both energy and emissions when we transform the inefficient, costly, and polluting sectors of transportation and heating that make up the vast majority of our fossil fuel use and emissions.

Beyond reducing climate pollution, meeting these goals will save Vermonters money and strengthen our local economy. Renewable heating options like advanced wood heat and cold climate heat pumps have lower and more stable fuel prices than fossil fuel systems. Importantly for transportation, which imposes the largest energy burden on Vermonters, total ownership costs for new EVs are now lower than comparable fossil fuel vehicles. And when we heat with renewables or drive electric vehicles, far more of our money stays here in Vermont, supporting jobs for our neighbors.

The status quo of Vermont's fossil fuel dependence is damaging our economy and health—especially for lower-income Vermonters. How we get to 90% by 2050 and reduce our climate pollution matters greatly. There are solutions available right now that can create a more just, thriving, and sustainable future for all Vermonters, and it is those we must prioritize.

As we do so, we can learn from the policy successes of places like California, Québec, and British Columbia, which have managed to significantly reduce emissions while also achieving impressive economic growth. Quite simply, Vermont will only meet its commitment to the Paris agreement (and 90% renewable by 2050) and drive significant green economic growth if we chart a similar, economy-wide path. Anything less is not worthy of our State's history of innovation and leadership, nor of our responsibility to the current and future generations who are counting on us to take comprehensive action now.

Jared Duval
Executive Director

Leigh Seddon
President

Key Activities: Convening the Network

In March 2018, EAN hosted an information session on the **Western Climate Initiative (WCI),** inviting members of the Québec delegation to speak to network leaders and state partners about the process and benefits of WCI.

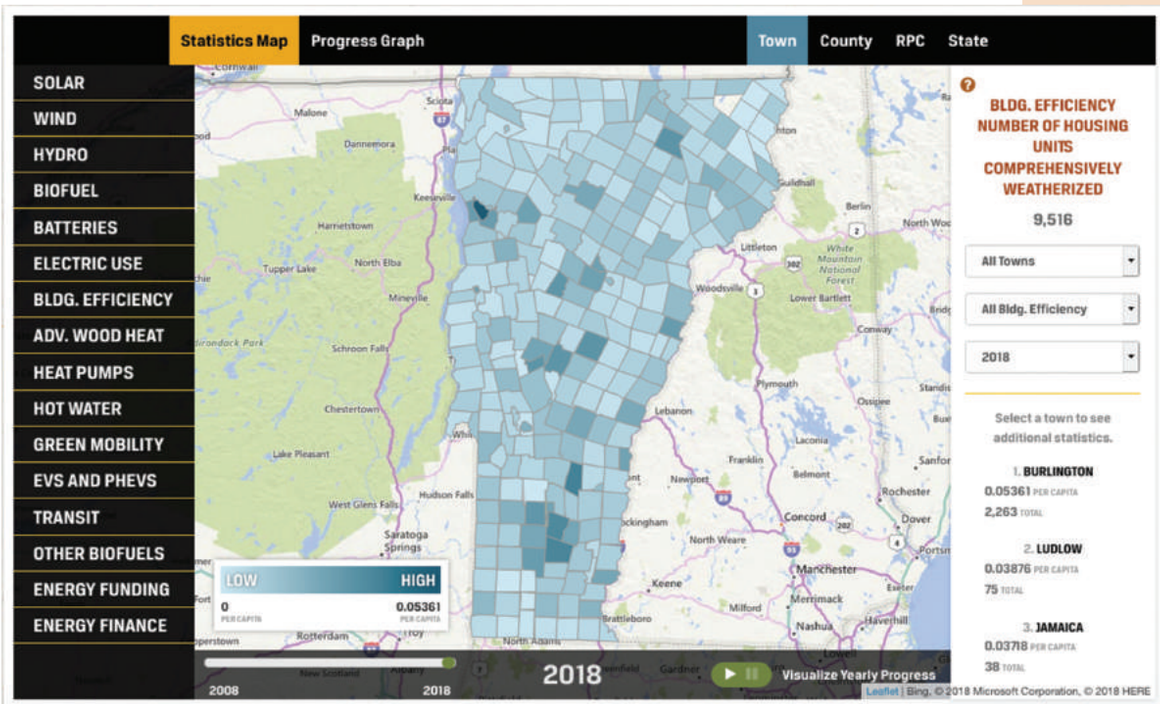
The success of this event inspired the launch of EAN's monthly **Leveraging Change Speaker Series,** which kicked off in November 2018 with a conversation about the Transportation & Climate Initiative (TCI) and the possibility to expand the Regional Greenhouse Gas Initiative (RGGI) model to cover GHG emissions beyond the electric sector. The events will continue throughout 2019 on the third Thursday of each month.

In fall 2018, EAN launched the **Vermont Energy Future Initiative,** a diverse, multi-sectoral group of leaders from across Vermont convened by the Energy Action Network. The shared goal of all Initiative members is to develop ideas and advance actions that can make significant progress towards meeting Vermont's 2025 total energy and emissions reduction commitments while creating a more just, thriving, and sustainable state for Vermonters.

Initiative members will be engaging in research and connecting with the broader network throughout 2019, culminating in **EAN's Annual Summit in fall 2019.**

Key Activities: Vermont Energy Dashboard Updates

EAN recently completed the **Community Progress Maps,** the newest tool in the suite of energy progress tracking tools found on the Vermont Energy Dashboard. This one-stop-shop for energy information and resources represents the first time that such a rich amount of total energy data has been presented all in one place, in a user-friendly and mappable way.



Users now have the ability to identify, analyze and map existing and promising locations for renewable energy and energy efficiency projects, quickly compare per-capita statistics, see annual changes by energy category, view all statistics for your community, and utilize a timeline feature to visualize progress over time

Thanks to dozens of data partners across the state, Vermont policymakers and planners can now see how their region and town compare on over 200 total energy metrics.

Visit the Community Progress Maps to discover how many electric vehicles or hybrids are registered in your town, the number of homes heated by cold climate heat pumps or advance wood heat, how many homes have on-site battery storage, and how many homes have recently been weatherized.

Climate Action Communities

In 2018, EAN continued to partner with the **Vermont Climate Action Communities (VCAC)** in their mission to help Vermont municipalities achieve deep energy efficiency savings, reduce local emissions and participate in the transition to a clean energy economy, improve resilience in the face of climate change, and provide locally supported renewable energy generation for municipalities and the communities they serve.

In partnership with the Vermont League of Cities and Towns and other participating organizations, EAN produced a **Municipal Resource Guide** for communities looking to take action, which can be found on the Dashboard. EAN also conducted a survey of over 100 municipal officials on town level efficiency and renewable action and interest and helped conduct regional workshops for town officials.

Who We Are: Member List

Energy Action Network (EAN) consists of over 100 active members representing businesses, utilities, nonprofits, 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.

Businesses

3E Thermal
Scott Campbell

AllEarth Renewables
David Blittersdorf, Nick Charyk

Bee the Change
Mike Kiernan

Black Bear Biodiesel
Jim Malloy

Bourne's Energy
Peter Bourne

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
Dan Kinney, Kevin McCollister

Dynapower
Adam Knudsen, Richard Morin

EAPC Wind Energy
Robert Sherman, Nicholas Laskovski

Encore
Chad Farrell, Phillip Foy, Derek Moretz, Chad Nichols

Energy Co-op of Vermont
Brian Gray

Energy Futures Group
Richard Faesy, Dan Mellinger, Gabrielle Stebbins

Forward Thinking
Jeff Forward

Fresh Tracks Capital
Cairn Cross, Lee Bouyea

Gardener's Supply
Jim Feinson

Grassroots Solar
Bill Laberge

Green Lantern Group
Luke Shullenberger, Bill Miller, Sam Carlson, Ralph Meima

L.W. Seddon, LLC
Leigh Seddon

KSV
Harrison Grubbs

Maclay Architects
Bill Maclay

MMR
Justin Johnson

Montpelier Construction
Malcolm Gray

National Life Group
Tim Shea

New Leaf Design
Tom Perry

Norwich Solar Technologies
Jim Merriam

NRG Systems
Justin Wheating, Anna Grady

Optimal Energy
Elizabeth Chant

Packetized Energy
Scott Johnstone, Kate Desrochers

Pellergy
Andy Boutin

Pomerleau Real Estate
Ernie Pomerleau

Rath Young and Pignatelli, P.C.
Mary Peterson

Regulatory Assistance Project (RAP)
Rick Weston

Reiss Building and Renovation
Chuck Reiss

Seventh Generation
Ashley Orgain

SunCommon
James Moore, Duane Peterson

Sunrun
Nathan Wyeth

Sunwood Biomass
David Frank

Union Mutual Insurance
Michael Nobles

Vanesse Hangen Brustlin, Inc (VHB)
Carla Fenner

Vermont Economic Development Authority (VEDA)
Jo Bradley

Vermont Housing Finance Agency
Maura Collins

Vermont Wood Pellet Co.
Chris Brooks

VSECU
Rob Miller, Laurie Fielder, Simeon Chapin

Utilities

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

Efficiency Vermont
Rebecca Foster, Barry Hulce, Abby White, Paul Markowitz, Kelly Lucci

Green Mountain Power
Mary Powell, Brian Otley, Robert Dostis, Kristin Carlson, Josh Castonguay

Hardwick Electric Department
Mary Westervelt

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

Vermont Electric Cooperative
Rebecca Towne, Andrea Cohen, Jake Brown

Vermont Gas
Don Rendall, Tom Murray, Tiana Smith

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

Washington Electric Coop
Patty Richards, Barry Bernstein, Roger Fox

Nonprofits

Associated Industries of Vermont (AIV)
William Sayre

Audubon Vermont
David Mears, Margaret Fowle

Biomass Energy Resource Center
Adam Sherman

Building Performance Professionals Association of Vermont
Jonathan Dancing, Malcolm Gray

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

LocalMotion
Karen Yacos, Ross Saxton

Neighborworks of Western Vermont
Ludy Biddle, Melanie Paskevich

New England Grassroots Environmental Fund
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, Ansley Bloomer

Shelburne Farms
Megan Camp

The Nature Conservancy
Heather Furman, Phil Huffman

UVM Medical Center
Dawn LeBaron

Vermont Businesses for Social Responsibility
Jane Campbell, Dan Barlow

Vermont Climate and Health Alliance
Dan Quinlan

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

Vermont Energy and Climate Action Network (VECAN)
Johanna Miller

Vermont Energy Education Program
Cara Robechek, Mariah Keagy, Stephen Knowlton

Vermont Energy Investment Corporation (VEIC)
Jim Madej, Christine Donovan, Karen Glitman, David Hill, Damon Lane, Jennifer Wallace-Brodeur, Richard Donnelly, Mary Sprayregen, Peter Adamczyk, Justine Sears, Zoe Erdman, Kerrick Johnson

Vermont Interfaith Power and Light
Richard Hibbert, Sam Swanson, Betsy Hardy

Vermont Land Trust
Nick Richardson

Vermont League of Cities and Towns
Karen Horn, Abby Friedman

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

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

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

Vital Communities
Tom Roberts, Sarah Brock

Higher Education

Champlain College
Donald Laackman

Dartmouth College, Tuck School of Business
April Salas

Goddard College
Robert Kenney, Catherine Lowther

Middlebury College
Diane Munroe, Dan Suarez

Norwich University, Center for Global Resilience and Security
Tara Kulkarni

Pace Law School Energy and Climate Center
Sam Swanson

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, Eric Zencey

Vermont Law School
Thomas McHenry, Michael Dworkin, Kevin Jones, Christa Shute

Vermont Technical College
Pat Moulton

Public Partners

LOCAL

Legislators: *Vermont's State Representatives and Senators*

Energy Committees: *Town Energy Committees from across Vermont*

Cities and Towns: *Burlington (Mayor Miro Weinberger; Neale Lunderville, CEDO Director), 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 (Northern Vermont Development Association)*

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

STATE

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

Agency of Commerce and Community Development: *Michael Schirling, Ted Brady*

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

Agency of Transportation: *Joe Flynn*

Dept of Buildings and General Services: *Chris Cole*

Dept of Environmental Conservation: *Emily Boedecker, Rebecca Ellis*

Dept of Financial Regulations: *Michael Pieciak*

Dept of Forests, Parks and Recreation: *Michael Snyder, Sam Lincoln*

Dept of Public Service: *June Tierney, Riley Allen*

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

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

Vermont State Treasurer: *Beth Pearce*

FEDERAL

Office of Congressman Peter Welch: *George Twigg*

Office of Senator Bernie Sanders: *Haley Pero*

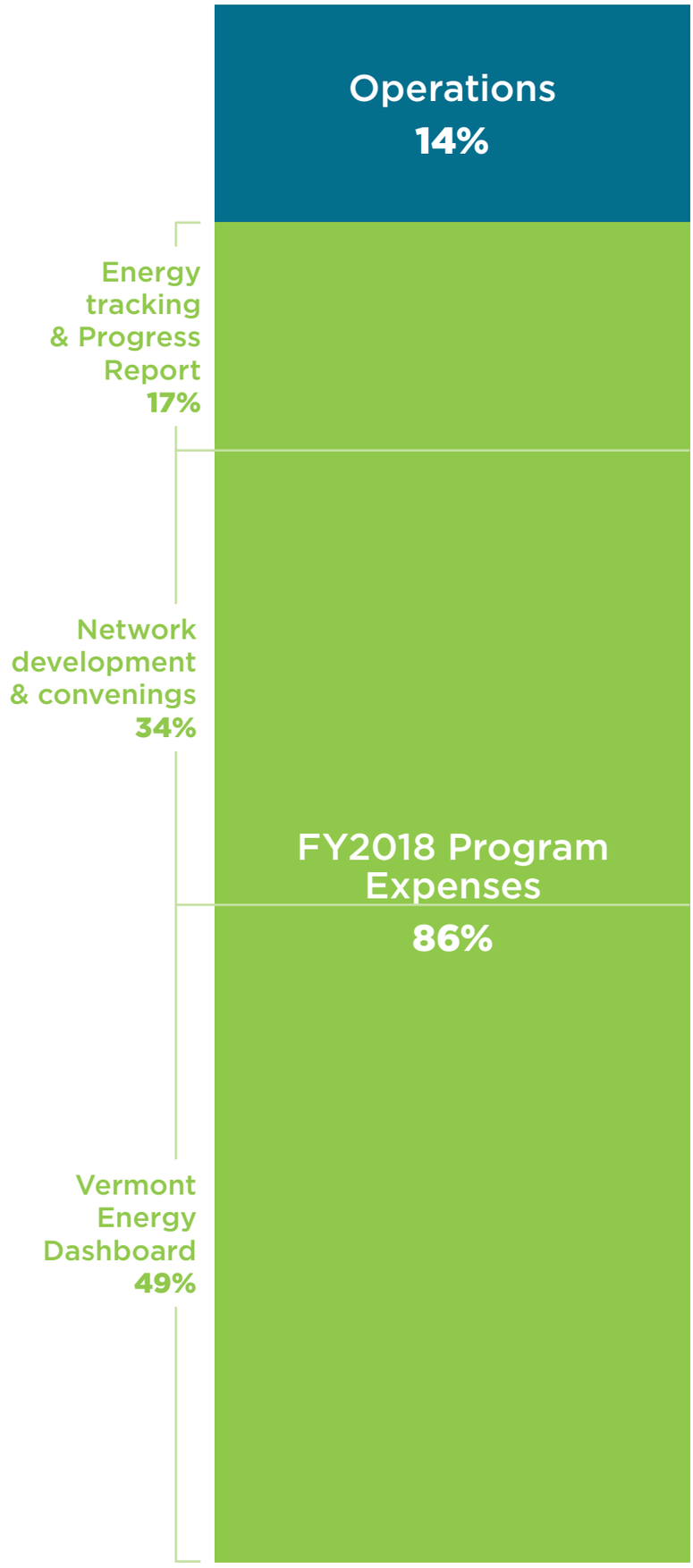
Office of Senator Patrick Leahy: *Tom Berry, Chris Saunders*

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

Funding, Expenses & Financial Sustainability

In the past year, EAN has maintained and strengthened ties with our existing funders while engaging several new supporters as well.

The charts below show the broad components of EAN's budget for Fiscal Year 2018. Overall, 86% of EAN's budget supported direct program work and the development of the capacity of our network. Operations costs continue to be small and highly leveraged in support of active, value-added programs.



TOTAL EXPENSES

FY18 Program Expenses	$338,161
Operations (Admin & Office)	$53,954
Total Expenses	**$392,115**
FY 2019 Program Contracts	$93,951
TOTAL EXPENSES & FUND ALLOCATIONS	**$486,066**

TOTAL REVENUES

Maverick Lloyd Foundation	$150,000
VLITE	$97,500
Garfield Foundation	$60,000
High Meadows Fund	$50,000
John Merck Fund	$50,000
Sustainable Future Fund	$25,000
VSECU	$20,000
Efficiency Vermont	$11,868
USDA Rural Development	$8,051
Burlington Electric Dept.	$6,650
Summit Revenue	$6,550
Other	$447
TOTAL REVENUES	**$486,066**

2018 Board of Directors & EAN Staff

Board of Directors

LEIGH SEDDON
EAN Board Chair
L.W. Seddon Consulting, President

ELLEN KAHLER
EAN Treasurer
Vermont Sustainable Jobs Fund, Executive Director

KAREN GLITMAN
EAN Secretary
Efficiency Vermont, Director

ROB MILLER
VSECU, President and CEO

CHRISTINE DONOVAN
VEIC, Director, Business Strategy and Innovation

DARREN SPRINGER
Burlington Electric Department, General Manager

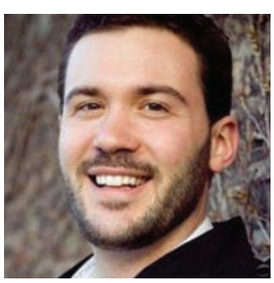
MARY PETERSON
Rath, Young and Pignatelli, P.C., Senior Counsel

JIM MERRIAM
EAN Leverage Point Advisor
Norwich Solar Technologies, CEO

JIM SULLIVAN
EAN Leverage Point Advisor
Bennington County Regional Commission, Exec. Director and Planning Program Coordinator

SARAH BROCK
EAN Leverage Point Advisor
Vital Communities, Energy Program Manager

Staff



JARED DUVAL
Executive Director

SARAH WOLFE
Network Director

ROB FISH
Vermont Energy Dashboard Manager

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ENERGY ACTION NETWORK

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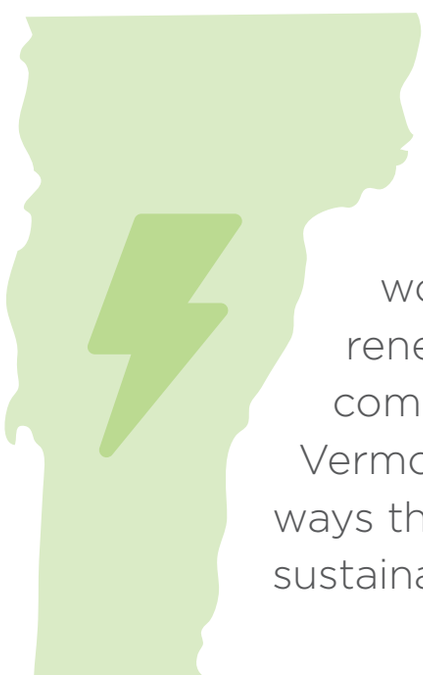

Energy Action Network (EAN) works to achieve Vermont's 90% renewable by 2050 total energy commitment and to significantly reduce Vermont's greenhouse gas emissions in ways that create a more just, thriving, and sustainable future for Vermonters.