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The Power of Solar in Your Community

Lowering your town, county and school taxes with benefits

Wiltshire rams grazing on solar salad mix at a community solar farm in New York. (United Agrivoltaics)

N.R. Mallery and G. Harvey

Berne, New York is a small rural community near Albany, the state capital. It is in some ways similar to many other towns across the United States. Its population was 2,695, at last count, and its character is mostly rural or residential. Established businesses are sufficient for many needs and are strongly connected with the community. The struggles are real because of the cost-of-living increases and community solar can be financially advantageous to the community.

Berne was originally part of the Dutch settlements along the Hudson River and appears in history in about 1750, but it was already settled by that time. Of course, as in many communities it has long-time residents, who have been there for their whole lives, and carry on their family traditions. Now Berne has opportunities that may have some very positive future impacts for the community.

One of these opportunities has to do with property taxes. The pandemic brought difficulties into the lives of many people. As a result of the financial struggles in Berne, the town decided that the tax rate should be reduced as much as possible to help with the hardships. The property tax rate was

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The World Is Burning Around Us, Elmo ...

Martin Wahl

… is how YouTuber Steven McInerney famously responded to Elmo's January 29 post on X (formerly Twitter) asking "How is everybody doing?" Well, Mr. McInerney is not wrong – the world is experiencing larger wildfires at an increasing rate. The Copernicus Atmosphere Monitoring Service shows record-breaking fires around the globe in 2023 generating 2,170 million tons of CO_2 and worsening the greenhouse effect. To put that in perspective, all the gas and diesel vehicles in the U.S. emitted 1,488 million tons in 2022.

In 2015, 200 nations agreed to try to limit global warming to 1.5° C (2.7° F) relative to pre-industrial levels. The world breached that increase last year, and 2023 is confirmed as the warmest calendar year in global temperature data going back to 1850. Montanans are even being cautioned that bears may not hibernate as much this year and people should be prepared for encounters with them. It has also been noted that bears in many areas of the northeastern U.S. have also not hibernated yet because it is too warm and they have plenty of food to forage.

The Canadian fires last year ranging from the Atlantic to Pacific coasts burned 71,414 square miles, the equivalent of

Elmo's posting on X got our attention when one reply said, "The world is burning around us, Elmo". (USAID Indonesia, Public domain, via Wikimedia Commons)

the *Green Energy Times*' readership area from northern New York through all of Vermont, New Hampshire, and Maine. In the U.S., smoke from the Canadian fires reached from New England to the mid-Atlantic states. Warming temperatures likely increased the hurricane winds that drove the deadly Maui fires with 100 lives lost. As the season changed over the new year, in the Southern Hemisphere fires are now raging in Chile and Australia, causing more than a hundred deaths in Chile and burning thousands of acres.

Not just fire danger

Global warming-caused atmospheric changes are also leading to

Cont'd on p.32

Gasoline is Cheaper – but Charging an EV is Still Cheaper

The average price of home charging an electric vehicle in the U.S. is equivalent to $1.41 per gallon

Karin Kirk

It was easy to make the case for the low cost of electric vehicle charging way back in 2022 when gasoline prices were high and charging an EV was about *70% cheaper* than filling up at the pump. But now that the price of gasoline is dipping below $3 per gallon, is it still cheaper to fill up a car on electrons rather than gasoline? The answer is yes — by a lot.

By far the least expensive and least polluting transportation option is to travelon foot, by bike or public transit. But if you need a personal vehicle, EVs cost less to drive compared to a similar gasoline-powered vehicle, and they also *emit less* carbon pollution.

A map is available *(https://www.datawrapper.de/_/tHeq1/)* which shows the price of charging an EV expressed in "eGallons," which is the cost of charging an EV by an amount equivalent to one gallon of gasoline. In other words, the map shows how cheap gasoline would have to be to be on par with the cost of at-home EV charging.

How much does EV charging cost?

In most parts of the country, charging an EV is equivalent to a gasoline price of $1 to $2 per gallon. The national average is $1.41 per eGallon, which is less than half *the current gasoline price* of $3.07 (as of Jan. 16, 2024).

Washington State and Louisiana have the lowest residential electricity rates, so those are the cheapest states to charge up an EV, clocking in at less than one dollar per gallon-equivalent. Electrified driving is an especially good

Cont'd on p.7

Concentration of CO_2 in the Atmosphere

423.87
parts per million (ppm)
February 12, 2024

Learn more at www.CO2.earth.

IN THIS ISSUE

We would like to encourage our readers to use the **interactive source links**, *in italics in print*, and available in the online editions of *Green Energy Times* at: **www.greenenergytimes.org**.

GREEN ENERGY TIMES (G.E.T.)

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"What has become clear from the science is that we cannot burn all of the fossil fuels without creating a very different planet." — Dr. James Hansen

Letter from the publisher

Challenges and Hope

Looking at this issue of *Green Energy Times*, I feel the dismay of the times, but I am also filled with hope. It is clear that we have challenges, but it may be even more clear that we have hope.

The article on the front page titled, "The World Is Burning Around Us, Elmo," reminds us of the sad state of the world. We are seeing increasing numbers of droughts and wildfires, paradoxically with storms and floods also problems. The damage comes to hundreds of billions of dollars.

On the same front page, there are other stories with an interesting message: We can address the problems causing climate change, saving money and making our lives more comfortable as we do. Why would anyone drive a gasoline-powered car, if an electric car is less expensive to drive, as it assuredly is. And since both a land owner and the rest of the community benefit economically when solar panels are installed, it is getting much more attractive to build solar arrays.

On page 3, we have an article about Mark Z. Jacobson describing the advantages of combining battery storage with renewable resources. Dr. Jacobson has been crunching numbers for years that show clearly the advantages of renewable energy and that neither fossil fuels nor nuclear power are needed. Here, he shows that hydrogen and fuel cells can have a place. Again, the message is that renewable energy and storage are enough.

Some people worry about agricultural land being used for solar arrays, but there are studies showing how to use 1% of the land for solar power and the rest for agriculture. One of them, on page 10, shows how to preserve agriculture in the Northeast. The grid gets more electricity, and the farms produce nearly the same amount of food.

On page 12, we see that community solar power is coming to New Hampshire. On page 14, we see that New York is getting really serious about offshore wind power, and that promises thousands of onshore jobs. On page 15, we learn how renewable energy is helping low-income households.

We are reminded of problems we must not deny, in the page 20 description of the decline of the snow pack in the Northeast. But then, on page 21, there is a description of geothermal heat pumps used for greenhouses. And this is followed on the next page with a story about the solutions are being used on college campuses. Heat pumps can reduce both our energy bills and our use of fossil fuels.

The strong admonition that we deal with the climate crisis, in the article, "Our Climate System is Moving Out of Control," on page 32, is followed on just the next page by "Can We End the Climate Crisis in One Generation?" And that has a long list of actions we can take.

Things can look bad – unless you see the whole story. What we really need to beat climate change is to act.

Think climate, think local, act global. …

– Nancy Rae Mallery ♻

Happy 'Everyday' Earth Day 2024

George Harvey

Each year, when *Green Energy Times* publishes an article about Earth Day, it seems to come out too late to be in readers' hands when Earth Day happens. *G.E.T.* comes out every other month, and we usually have the choice of carrying the article a few days before Earth Day or two months earlier. We usually choose the former, but not this time.

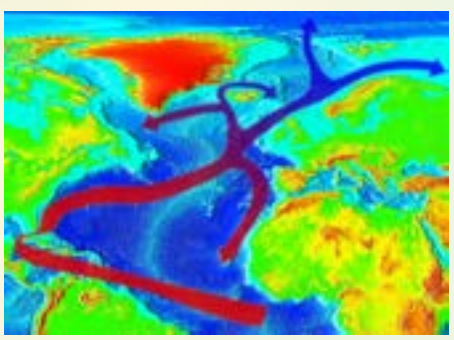
In this issue, we have an article, "Earth Day Events Expand to Earth Month," on page 4, in our transportation section. Five national organizations, Plug In America, the Electric Vehicle Association, the Sierra Club, EVHybridNoire, and Drive Electric USA, came together to celebrate Earth Day with a month of events promoting electric vehicles, a sort of Earth Month.

As we think about this, we might reflect on the news we have seen of late. We have floods, fires, storms, droughts and more. We want to act to stop climate change. And we are acting, but together, we are not doing nearly enough.

Now we have news that the Atlantic meridional overturning circulation, often abbreviated AMOC, is showing early signs of collapse. [See image] If it does collapse – a very big "if" – there would be a drastic change in climate conditions all over the world, starting especially in Northern Europe. That has staggering implications for our lives. (We will cover this more in the next issue of *Green Energy Times*.)

It is possible that there is nothing we can do to prevent such an event, if it is coming. But there are things we can do to prepare for it. Fortunately, they are mostly things *G.E.T.* has been covering and publishing for years. Among them would be: become more energy independent, possibly by getting our own solar photovoltaic systems; keep a garden and save seeds, whether at home or in a community garden; get an electric vehicle, or better yet start walking or biking. The list goes on and on.

Perhaps Earth Day should not be treated as a one-day event. Perhaps we should celebrate Earth Day every day. Or make every month Earth Month. Make every year Earth Year. And actually, make things better. That sounds more hopeful. ♻



The Gulf Stream by RedAndr, CC-BY-SA 4.0 (https://bit.ly/AMOC_map).

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Please note that interactive source links for all articles are available in the online edition on our website: www.greenenergytimes.org.

Future Energy Systems Set Aside Need for Fossil Fuels for Electricity

Study Shows that Combining Battery Storage with Fuel Cells Ensures Reliability

A new groundbreaking study done at Stanford University demonstrates that combining battery storage with hydrogen fuel cells can now ensure low-cost reliability when countries, including the U.S., transition to electricity grids powered by 100% clean, renewable sources.

In the first study of its type, Stanford engineering professor Mark Z. Jacobson used cutting-edge computer modeling to address the common notion that fossil fuels – rather than a combination of renewables, battery storage, and hydrogen fuel cell storage – are needed to keep the lights on 24/7, 365 days a year at low cost throughout the world. As the world undergoes a new industrial revolution, turning away from fossil fuels to renewables in order to address air pollution, energy security and the climate crisis, the Stanford study provides a key missing piece of the puzzle.

The study finds that transitioning to clean power can reduce countries' overall annual energy costs by around 61%.

***"At this point, anyone saying that we need fossil fuels, nuclear, or any other conventional energy resource to keep the lights on 24/7 hasn't done the analysis,"* Jacobson said.**

He continued, "This study will help planners create a more efficient and cost-effective future energy system based on clean, renewable electricity. The results provide countries with concrete evidence and the confidence that 100% clean, renewable grids not only lower costs but are also just as reliable as the current grid system."

Wind turbines and solar power are rapidly replacing fossil fuels worldwide as a source of electricity. However, the wind does not always blow and the sun does not always shine, leading to fears of power outages. Currently, hydroelectric power and fossil gas provide most backup when insufficient coal, nuclear, or other electricity is available. What happens, though, when a country transitions to 100% renewable electricity, thereby eliminating fossil gas backup? Two of the main contenders for replacing fossil gas for storage are batteries and green hydrogen used in fuel cells. Green hydrogen is hydrogen produced from renewable electricity, such as wind, solar, or hydroelectricity.

Lecturing is part of the job for Mark Z. Jacobson. (Ecolo)

Electricity storage is used for two main purposes: providing short bursts of large amounts of power and providing lesser amounts of power for a long time. Although batteries can be linked together to provide both short-term power and long-term energy storage, they are more cost-effective for short-term (seconds to hours) power bursts than for long-term (hours to days or weeks) storage. Green hydrogen storage, on the other hand, is more cost effective for long-term energy storage than for short-term power bursts. Hydropower can be used for both short power bursts and long-term energy storage.

Jacobson analyzed the cost of keeping the grid stable in 145 countries powered for all energy purposes (electricity, transportation, buildings, industry, agriculture, forestry, fishing, and the military) by clean, renewable energy, i.e., electricity and heat coming from wind, hydroelectric, geothermal, and solar sources. The main electricity storage options included existing hydropower dams, batteries and green hydrogen.

The study found that existing hydropower plus batteries avoids blackouts throughout the world. However, adding green hydrogen to the mix reduces energy overall cost in some regions. Using hydropower and green hydrogen but no batteries is always more expensive than using hydropower with both batteries and green hydrogen.

The main reason for this result is that every region in the world needs short-term bursts of power with 100% renewables on the grid (thus every region needs either hydropower or batteries), but not every region needs new long-term storage. This is because such regions have either a good combination of wind and solar resources that provide energy continuously over long periods, have a lot of existing hydropower for long-term storage, and/or can use the same number of new batteries they use for short power bursts for long-term storage as well.

Jacobson also found that combining hydrogen production and storage for grid purposes and non-grid purposes (steel production, ammonia production, and long-distance, heavy transport) generally reduces overall energy cost relative to separating such production and storage, due to economies of scale

The study was carried out through three types of computer modeling: a three-dimensional global weather-climate-air pollution model; a spreadsheet model and a model that matches electricity; heat, cold, and hydrogen demand with supply, storage and demand response assuming perfect grid connection.

Five countries already have 100% renewable electricity grids, ten have 97.3% to 100% renewable grids, and 35 have 50% to 100% renewable grids. Such grids are mostly dominated by hydropower, though. In *eleven U.S. states*, 51% to 97% of the equivalent electricity consumed is powered by renewables, with seven of those states dominated by wind and one by solar.

The study was published in *iScience.*

Mark Z. Jacobson is director of Stanford University's Atmosphere/Energy program; a senior fellow at the Precourt Institute for Energy; a senior fellow at the Stanford Woods Institute for the Environment, and author of No Miracles Needed: How Today's Technology can Save our Climate and Clean our Air. ♻

Lauren Hierl

Over the past year, Vermonters have experienced firsthand the growing threats to our environment and communities posed by the climate crisis, including devastating flooding, water polluted by runoff, dangerous blue-green algae blooms, and poor air quality due to distant wildfires. The urgency for climate action continues to build – and Vermont is fortunate to have a strong group of environmental organizations working together to advocate for necessary solutions.

At the start of each legislative session, Vermont Conservation Voters (VCV) publishes the Vermont Environmental Common Agenda. The agenda represents the priorities of a range of organizations across Vermont working on matters affecting our shared natural resources, the character of our communities, and public health. With the start of the 2024 legislative session in early January, VCV is proud to release *this year's Environmental Common Agenda* alongside 18 partner organizations. This document highlights this year's high priority legislation needed to address the complex challenges our state is facing.

Ensuring our communities are safer from the impacts of climate-induced flooding is top of mind for legislators, advocates, and community members who know how damaging these events have been. This year's Common Agenda proposes a suite of policies that can support Vermont in becoming more resilient to floods. We must give rivers room to meander by keeping river corridors free from new development, and we must establish a policy to ensure Vermont is protecting and restoring wetlands, as they are a nature-based solution to flooding. Wetlands store, filter and purify our water, and provide habitat for plants and animals. Furthermore, by shoring up the safety and oversight of Vermont's dams, and removing those that serve no purpose, we can protect communities downstream during flood events.

Continuing to reduce our carbon pollution and help Vermonters access affordable, clean energy remains a priority as the state continues to march toward the necessary and ambitious emissions reduction requirements of the Global Warming Solutions Act. This year's Common Agenda outlines essential reforms to modernize Vermont's Renewable Energy Standard (RES), and to help ensure that Vermont is swiftly and comprehensively transitioning to locally generated, new renewable energy to reduce our reliance on fossil fuels.

Implementation of climate mitigation and resilience strategies comes at a cost. By holding the largest fossil fuel companies accountable, and by establishing funding structures to leverage state and federal funds, we believe Vermont can secure revenue streams to invest in these critical initiatives. Furthermore, as transportation remains Vermont's largest source of carbon pollution, we need to continue to invest in clean transportation solutions such as electric vehicles, transit and micro-transit, and bike and pedestrian infrastructure. The Legislature should also explore pathways for Vermont to participate in cap-and-invest or similar regulatory programs to build a statewide transportation system that is more cost-effective, multi-modal and accessible to all Vermonters.

We also know that in addition to the climate crisis, Vermont is experiencing a housing crisis. Our central land use and development law, Act 250, must be updated to promote the development of

Cont'd on p.33

Earth Day Events Expand to Earth Month

Many thanks to our sponsor:

efficiency MAINE

Sherry Boschert

First came National Drive Electric Day, more than a decade ago, when electric vehicle (EV) drivers gathered at events to show their cars and e-bikes and talk about their experiences with the EV-curious who came to ask questions. That expanded in 2014 to National Drive Electric Week events across the United States each year near the end of September. More recently, similar events also have celebrated Earth Day each spring, and they became so numerous that national organizers have declared Drive Electric Earth Month for April 2024.

A lot is happening with EVs this year. Starting in January 2024, consumers who want to buy an EV may "transfer" a federal tax credit to participating car or truck dealers to get up to a $7,500 cash-on-the-hood price reduction instead of waiting to claim the credit in tax filings next year. There are income limits on who can participate, and only designated EVs are eligible, but here's a beneficial change – you don't have to owe $7,500 in taxes in order to participate.

And this is not just for new EVs. Buyers of used EVs can get up to a $4,000 credit (or price reduction). For more details on all the new rules, see Plug In America's handy "*Federal Tax Credit Checklist for EV Shoppers*."


Jay and Polly Campion inspect a Ford E-Transit van at an EV Expo

Plus, this year many EVs will be able to start using Tesla's nationwide charging network – a game-changer for easy long-distance travel.

Learn about these topics and much more from EV drivers and e-bike riders themselves or from participating dealers at the Drive Electric Earth Month events. Maybe even take a test ride. Or do you already have an EV or e-bike? You can register to come show your vehicle and talk to event visitors who have questions, just like you had when you first considered getting an EV.

Drive Electric Earth Month is coordinated by five national organizations – Plug In America (*pluginamerica.org*), the Electric Vehicle Association (*myeva.org*), the Sierra Club (*sierraclub.org*), EVHybridNoire (*evhybridnoire.com*), and Drive Electric USA (*driveelectricusa.org*).

Find a Drive Electric Earth Month event near you and register by visiting *https://driveelectricearthmonth.org*. Here is a sample of events in New England that were announced by early February:

Saturday, April 6

South Portland, ME – *EV Expo*, Saturday, April 6, 11:00 a.m. to 2:00- p.m., The Point Community Center, 345 Clarks Pond Parkway, South Portland, ME. The EV Expo, sponsored by ReVision Energy and Efficiency Maine, is part of the larger Green Home + Energy Show that features leaders in Maine's sustainable home and energy industries. See exhibits on solar power, heat pumps, EVs, green home products, and more, and network with top professionals who are looking to hire within these fields.

Saturday, April 20

Nashua, N.H. – *Nashua Sustainability Fair and Earth Day Celebration*, Saturday, April 20, 9:30 a.m. to 2:30 p.m., Nashua Public Library, 2 Court Street, Nashua. The Electric Vehicle Show at this third annual event will include not just EVs but a discussion by Clean Energy NH about, "Are EVs Right for You?" Plus, activities for kids, music, food trucks, information about home weatherization or sustainable plantings, and more.

Keene, N.H. – *Drive Electric Expo at Earth Festival*, Saturday, April 20, 12:30-3:30 p.m., 93 Railroad Street, adjacent to the Monadnock Food Co-op in downtown Keene, which hosts the region's first public fast-charge stations. Featuring EVs shown by individuals, city staff, and local businesses.

Sunday, April 21

West Lebanon, N.H. – *Earth Day EV Expo*, Sunday, April 21 from 12:00 noon to 3:00 p.m. in West Lebanon at 10 Benning Street (the Shaw's supermarket parking lot). The location is adjacent to a new fast-charging station being installed by the electric truck maker Rivian. Rivian owners will be there to show their trucks, plus other EVs from Lebanon Ford and drivers of other models. The event features related exhibits like EV charging station company SolaflectEV, which offers a solar-powered EV charger. Pre-register at NHEV.org to get a free raffle ticket. Organized by the Lebanon Energy Advisory Committee. Co-sponsored by NH Sierra Club, 350 New Hampshire, and New Hampshire Businesses for Social Responsibility.


Sherry Boschert in a F-150 frunk. (Image: Meg Newman)

Saturday, April 27

Merrimack, N.H. – *Electric Vehicle Fair*, Saturday, April 27 from 10:00 a.m. to 2:00 p.m., Tractor Supply Parking Lot, 515 Daniel Webster Highway, Merrimack. Drivers will be bringing a Hyundai Ioniq 5, a Rivian R1S truck, and a Zero motorcycle, among others, and you can see some battery-powered outdoor equipment as well.

U.S. consumers face an urgent need to reduce greenhouse gas emissions in order to keep our one and only planet livable for our children and grandchildren. Now is the time to visit a Drive Electric Earth Month event and consider switching to electric drive. Later is too late.

Sherry Boschert is co-captain of the Earth Day EV Expo in West Lebanon and a co-founder of PlugInAmerica.org. ♻

First USPS Electric Vehicle Charging Stations and EV Delivery Vehicles Unveiled

UNITED STATES POSTAL SERVICE®

On January 22, the United States Postal Service (USPS), alongside White House officials, unveiled its first set of electric vehicle (EV) charging stations at its South Atlanta Sorting and Delivery Center (S&DC). Charging stations like these will be installed at hundreds of new S&DCs across the country throughout the year and will power what will be the nation's largest EV fleet. Electrification and modernization of the Postal Service's delivery fleet is part of the organization's $40 billion investment strategy to upgrade and improve the USPS processing, transportation, and delivery networks.

"The improvements we need to achieve in sustainability are an integral outgrowth of the broader modernization efforts we have undertaken through our 10-year Delivering for America plan," said Postmaster General Louis DeJoy. "As we transform our operating processes and invest in new automation, new technologies, and upgraded facilities and vehicles, we will generate significant efficiencies that reduce our costs, slash our carbon footprint and minimize waste. We are grateful for the support of Congress and the Biden Administration through Inflation Reduction Act funding, which helped enable the electrification in evidence here today."

"In every neighborhood in America, people know their postal carrier and recognize the USPS vehicle driving down their street," said John Podesta, Senior Advisor to the President for Clean Energy Innovation and Implementation. "The work USPS is doing to electrify those vehicles is making EVs commonplace on every road and street in our country, while reducing air pollution and increasing comfort and safety for the dedicated public servants who deliver our mail."

"Today is a victory for *Cont'd on p.6*

How EV Tax Credits Affect Vehicle Depreciation

Jesse Lore

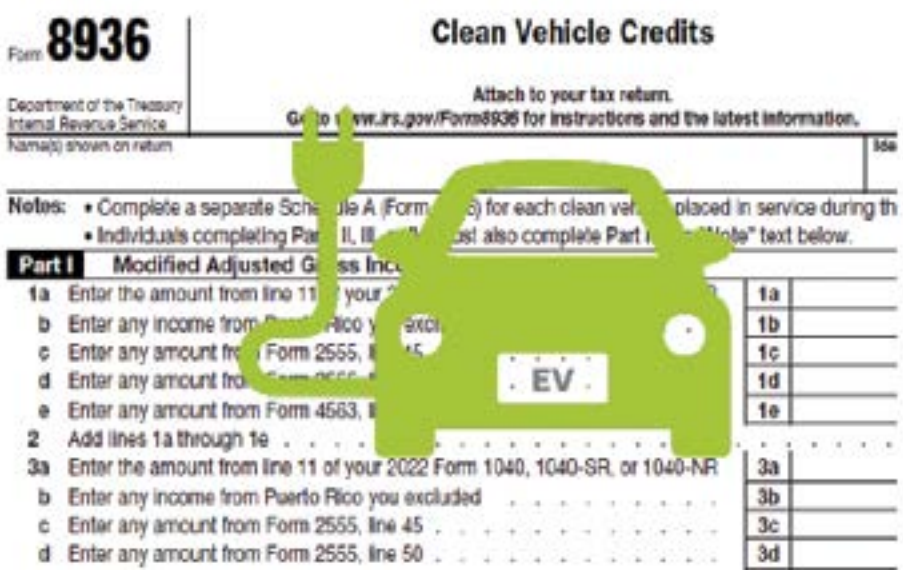

(Mikes-Photography from Pixabay)

For most Americans, their car is their largest or second largest asset (after their home), and because a car is usually a depreciating asset, how fast it depreciates has significant bearing on their owner's financial wellbeing. Depreciation for internal combustion engine (ICE) cars is more commonly understood, but because EVs are relatively new to the market, the math around depreciation can be a little more confusing. In this article, we will try to clarify the biggest factor - tax credits - so that you can have a better understanding of how your electric vehicle's value will hold up, as well as some tips to make sure that you can protect your investment.

The bottom line is this: *electric vehicles depreciate by the amount of the tax credit that is available on that EV whether or not the purchaser is eligible for the credit or actually receives the credit.* There is a lot of money at stake here, so before you purchase an EV, you should know (a) whether there is a tax credit available on the car you want to buy; (b) whether or not you are eligible for the tax credit; and (C) how your car's value is affected.

The Inflation Reduction Act of 2022 provided a huge boost to the electric vehicle industry by updating the federal tax credits available to EV purchasers. New for 2024, some new electric vehicles can get up to $7,500 off, and used electric vehicles can get up to $4,000 off at point of sale. The dealer must participate in the IRS clean vehicle tax credit program in order for you to use that tax credit when you buy the vehicle. You can learn more on the IRS website, and see which vehicles qualify on FuelEconomy.gov.

Now there are important limitations to these credits. For new vehicles there are sourcing and manufacturing requirements for the EV battery, and there are income limits for the purchaser for new vehicle and used vehicle credits. There is a $25,000 price limit on tax credits for used EVs as well. A vehicle can only receive each tax credit one time and if the purchaser does not receive the tax credit, the next purchaser is not able to receive the credit either.


Form 8936 Clean Vehicle Credits

Attach to your tax return.

Department of the Treasury Internal Revenue Service

Name(s) shown on return

Notes: • Complete a separate Schedule A (Form 8936) for each clean vehicle placed in service during th

• Individuals completing Part II, III, or IV must also complete Part I. See "Note" text below.

Part I Modified Adjusted Gross Income

1a Enter the amount from line 11 of your 2022 Form 1040, 1040-SR, or 1040-NR 1a

b Enter any income from Puerto Rico you excluded 1b

c Enter any amount from Form 2555, line 45 1c

d Enter any amount from Form 2555, line 50 1d

e Enter any amount from Form 4563, line 15 1e

2 Add lines 1a through 1e

3a Enter the amount from line 11 of your 2022 Form 1040, 1040-SR, or 1040-NR 3a

b Enter any income from Puerto Rico you excluded 3b

c Enter any amount from Form 2555, line 45 3c

d Enter any amount from Form 2555, line 50 3d

EV

This last one makes intuitive sense for new vehicles. Once the vehicle is sold when it is new, it is now a used vehicle, so it would not qualify for a new vehicle credit at any subsequent sale. But for used vehicles, any electric vehicle that was purchased after August 16th, 2022 as documented on the vehicle history report (e.g. CarFax) is not eligible for a Used Clean Vehicle Tax Credit on any subsequent sale, regardless of whether it was purchased previously for $25,000 or less.

Let's talk about new vehicle depreciation first, and take the example of a 2023 Volkswagen ID.4 Pro S all-wheel drive, with an MSRP of $54,090 including delivery. This vehicle qualifies for the full $7,500 new EV tax credit, so if you purchase it from a dealer who is participating in the IRS point of sale program, you will only pay about $46,590 plus taxes and fees. But if you are fortunate enough to make more than $300,000 per year (the IRS income limit on this credit for married taxpayers filing jointly), then you not only don't get the tax credit, but your vehicle depreciates by $7,500 as soon as you take ownership. That is because second owners, who you would sell your vehicle to, would compare the price at which they could buy your vehicle with the price of a new one. So, if you put 1,000 miles on your ID.4 and decided to sell it, the most money a rational purchaser would pay for that car is less than $46,590 (the sale price minus the tax credit). This income limitation impact to depreciation also applies to the used clean vehicle credit, but the income limits are half of what they are for new vehicles.

For used vehicles, the problem of depreciation is even more complicated. Let's take that same ID.4. If you purchased that vehicle in May 2022, drove it for 15,000 miles and sold it to someone else in 2023 for $35,000, the vehicle will never qualify for the Used EV Tax Credit under current law, because it was already transferred to another purchaser after the passage of the IRA. Compare that vehicle to an identical vehicle (call it "Vehicle B") that someone bought new at the same time but drove it for three years and 45,000 miles, and then sold it. Vehicle A (same mileage and condition as vehicle B) is no longer eligible for the tax credit, but vehicle B is still eligible (because Vehicle B was not transferred to a qualified purchaser after passage of the IRA). So, if vehicle A is worth $18,000 at this point, vehicle B is worth as much as $4,000 more because it is still eligible for the Used Clean Vehicle Credit… provided that the dealer to whom you sold the vehicle can still offer the vehicle for $25,000 or less.

There are still a lot of unknowns with the new Clean Vehicle Tax Credit program. According to the IRS, for a vehicle to qualify, the dealer must report the sale to the IRS, according to the IRS website. So, if you buy an EV from a dealer and you don't get the tax credit at point of sale, you may not be able to claim that tax credit on your taxes the following year. That is a double-whammy: you don't receive the tax credit AND your vehicle depreciates by the tax credit amount!

Buying an EV is more affordable than ever before, and owning an EV is the most affordable of any type of vehicle, with less cost for fuel, maintenance, and repairs. Also, you get a more fun car that helps you save the planet! But you have to be savvy when it comes to tax credits when you buy the vehicle, and work with a dealer that understands these credits and can get them to you at point of sale. Otherwise, one of your most valuable assets could lose more value more quickly than you expect.

Jesse Lore is the owner of Green Wave Electric in Hampton, New Hampshire. ♻

LATE BREAKING NEWS

Despite What You May Have Heard, U.S. Electric Vehicle Sales Are Poised to Rise a Lot in 2024

Inside Climate News, by Dan Gearino, February 8, 2024

While there are some serious challenges surrounding EVs - such as the need to build out the nation's charging infrastructure - leading forecasters such as AutoPacific, Cox and S&P Global Mobility agree that sales and market share will continue to grow in 2024. Their projections show increases in EV sales ranging from about 20 percent, from AutoPacific, to more than 30 percent from the others, compared to the prior year.

The forecasters expect EV market share to reach 9 percent to 11 percent this year, which would be a substantial increase from the prior year. They all pointed to the lack of charging infrastructure as a major factor holding some people back from buying an EV. Another major impediment is that the market doesn't yet have enough EVs that cost $35,000 or less.

Learn more at Inside Climate News at: https://bit.ly/EV_sales.

New Zero-Emission, Mobile EV Charging Platform and Recharging Solution

New e-Boost Platforms deliver net-zero EV charging where it is needed, when it is needed; allowing charging for EVs off-grid (or during grid outages)

On January 23, Pioneer Power Solutions, Inc. (Nasdaq: PPSI) ("Pioneer" or the "Company"), a leader in the design, manufacture, service and integration of electrical power systems, distributed energy resources, power generation equipment and mobile electric vehicle ("EV") charging solutions, announced that it is launching its first zero-emission platforms.

Developed in partnership with NOMAD Transportable Power Solutions, Inc. (NOMAD), the leading domestic manufacturer of zero-emission, utility-scale mobile energy storage, Pioneer's Zero Emission e-Boost ("ZEeB") and EXZELCR platforms set a new bar in meeting the growing demand for low-carbon, mobile, e-Boost solutions with grid-gap solutions.

Under development with NOMAD since last year, the companies collaborated to design and test the platforms' architecture. Like all of Pioneer's e-Boost platforms, ZEeB and EXZELCR are mobile, but the new platforms offer the added benefit of battery energy storage to provide zero-emission EV charging. The new solutions will allow EV charging for a wide range of markets including at events, in remote locations, for disaster response, or even for fleet management where charging flexibility for a large number of EVs is a priority.

Pioneer eMobility is now offering the ZEeB to customers and is ready to begin delivery. The initial ZEeB has a 500-kW power capacity unit powered by KORE Power lithium-ion battery cells with 1.3 MWh energy storage capacity that can deliver more than five hours of EV charging with a 240-kW charger, more than 10 hours with a 120-kW charger or more than 21 hours with a 60-kW charger.

Later this year, the Company plans to introduce two larger ZEeB units offering 750 kW and 1 MW of capacity. The ZEeB is EV charger brand agnostic.

Pioneer's new EXZELCR is available to allow for immediate, mobile, emissions-free, off-grid recharging of the ZEeB, while also offering additional value. EXZELCR includes onboard availability for 3-phase, 2-phase, and single-phase power availability making it a complete Disaster Recovery ("DR") tool.

The mobile zero-emission and low-carbon recharge EV charging platform (Courtesy image)

With ZEeB and EXZELCR, the Company has created a hybrid EV charging system that provides zero emission EV charging wherever and whenever it is needed, and it can be easily recharged within hours by EXZELCR for continuous availability.

"While many battery energy storage solutions are available in the US market, they are severely limited by dependence on a high-power, near-site grid connection for recharging," said Nathan Mazurek, CEO of Pioneer. "By pairing a mobile battery energy storage solution with a mobile, low-carbon recharge system, we are opening immense possibilities for our customers. Whenever electricity becomes unavailable at a site, these units transform instantly into integral parts of a microgrid ("MG") or Distributed Energy Resource ("DER"), which we believe places them years ahead of their competition when it comes to peak demand shaving and resiliency."

Key features and benefits of the ZEeB and EXZELCR include:

- **Fast, EV Charging, Anytime, Anywhere:** Powered by a high-performance, mobile battery system, at 500 kW, it delivers exceptionally high-speed EV charging in the most remote or grid congested areas, enabling businesses to transition to EVs.
- **Compact Form Factor:** The compact design of both units makes them easy to transport and mobilize, simplifying EV charging for fleets, transit agencies, school bus depots, municipalities and sustainability events.
- **Enhanced Future Resiliency:** When grid connectivity comes to the client site, the ZEeB can be easily integrated with a grid connection into Pioneer's E-Bloc solution, which offers complete microgrid connectivity options and enables a comprehensive Distributed Energy Resource that can integrate rooftop or canopy solar and other renewable sources into the facility. ZEeb is designed to double as a disaster recovery unit that can provide raw 480V, 3-phase, 240V or 120V power for any site use in times or urgent needs.

"NOMAD is committed to delivering mobile energy storage solutions that fill the gaps in providing safe, clean, reliable power," said NOMAD CEO Paul Coombs. "Through our partnership with Pioneer, we're allowing fast EV charging to be deployed as needed, while eliminating the restrictions of stationary charging stations, all with units made in the US."

The Company believes that the launch of ZEeB and EXZELCR brings unrivaled EV charging flexibility, representing a significant step forward for EV deployment.

"The path to Net Zero will be a story of innovation and optimization, and with ZEeB and EXZELCR, our customers have a faster way to reach their EV charging and sustainability goals", commented Geo Murickan, head of Pioneer eMobility.

In addition to fleets in California with Class 8 vehicles that are already transitioning to meet the Advanced Clean Fleet regulations, many transit agencies, school bus depots, municipalities, ports and even air taxi (electrical Vertical Take-Off and Landing – eVTOL) entities have expressed interest in the current and higher capacity models.

"Our customers are ready to embrace the EV transition, and with the decentralized design offered by ZEeB and EXZELCR, these solutions will streamline EV adoption," Coombs added. ♻

USPS Chargers, EV Delivery Vehicles

Cont'd from p.4

the U.S. Postal Service, America's electric vehicle industry, workers, and the environment," said White House Council on Environmental Quality Chair Brenda Mallory. "USPS is leading by example by building the world's largest electric delivery vehicle fleet and delivering on President Biden's Investing in America agenda resulting in cleaner air, better health and good-paying jobs in communities across the country."

At the event, USPS also showcased new battery-powered and domestically manufactured commercial off-the-shelf (COTS) delivery vehicles that will make up a portion of the Postal Service's EV fleet.

Deployment of electric delivery trucks will start in Georgia and then expand to other locations across the country throughout the year. The vehicles feature air conditioning and advanced safety technology and are designed to meet modern operational requirements.

The procurement of EVs and charging stations is enabled by the Postal Service's overall network modernization efforts — which allow more rapid EV deployment — as well as its improving financial condition, which includes $3 billion in congressional funding appropriated under the Inflation Reduction Act (IRA).

State-of-the-art S&DCs are local hubs for EV deployment

As part of its 10-year Delivering for America (DFA) plan, the Postal Service expects to convert approximately 400 selected sites into S&DCs nationwide. These centers — which provide faster and more reliable mail and package delivery over a greater geographic area — will serve as the local hubs to deploy EVs along local carrier routes. As of January 2024, the Postal Service has opened 29 S&DCs nationwide.

Rendering of an electric USPS delivery truck. (USPS)

Building a nationwide network of electric vehicle charging stations ready to power USPS EVs

The charging stations displayed at the Atlanta S&DC were manufactured by Siemens. These stations will be able to efficiently charge Postal Service EVs overnight prior to the next day's deliveries. The Postal Service's first 14,000 EV chargers will be manufactured by three suppliers: Siemens, Rexel/ChargePoint, and Blink.

Ongoing commitment to electrifying America's largest and oldest federal fleet

The event featured battery electric COTS vehicles manufactured by the Ford Motor Company. USPS plans on procuring a total of 21,000 COTS EVs — including 9,250 from Ford — depending on market availability and operational feasibility. In addition, the Postal Service anticipates adding at least 45,000 battery-electric Next Generation Delivery Vehicles (NGDVs) by 2028, bringing the total number of EVs in the delivery fleet to more than 66,000. This represents one of the largest commitments to vehicle electrification in the nation. USPS will also continue to explore the feasibility of achieving 100% electrification for its delivery vehicle fleet.

In addition, updating and modernizing the Postal Service's fleet will allow delivery vehicles to haul larger volumes of mail and packages. For example, the Ford E-Transits displayed have nearly three times the cargo capacity of the Grumman LLV delivery vehicles that the Postal Service currently uses. Increased cargo capacity will reduce inefficient transportation, improve delivery operations and eliminate the need for many second trips carriers take to deliver high volumes of packages.

Sweeping USPS operations modernization advance sustainability efforts

The Postal Service's 10-year DFA transformation and modernization plan provides the foundation for the organization to continuously improve the sustainability of its operations. The environmental benefits of the DFA plan will increase as the Postal Service moves forward with this transformation, with every improvement to USPS operations — from new facilities to improved transportation utilization and delivery route refinements — helping reduce the organization's carbon footprint.

For more information regarding Postal Service sustainability efforts, visit the *Sustainability pages* on about.usps.com. ♻

E-bike Options, Benefits and Environmental Impact

Martin Wahl

It is not too early to start thinking about spring and how you can blend fun, exercise, and getting around efficiently as the weather improves. An electric bike helps achieve this, including accomplishing longer-range errands while minimizing your carbon footprint.

A 2024 Specalized Vado 4.0 ebike is available at Omer and Bob's in Lebanon, NH. (Courtesy image)

So, what kind of e-bike is best suited for longer-range needs, such as running errands or commuting?

For commuter and errands use, assume you'll be riding on roads primarily, not trails. Be prepared to master hills and keep up speed, so consider longer range batteries and adequate power. For errands involving shopping, look into models with larger carrying capacity, with racks and panniers.

Commutes are usually measured in driving time, not distance, but for the Green Energy Times readership area, it appears most commutes are between 15 and 25 miles one-way.

Considering e-bike speeds of about 20 mph, a 15-mile one-way trip will take around 45 minutes, and the battery range must be at least 40 miles to last a round trip with some reserve.

As to what type of e-bike, here are some considerations.

- Class 1, 2 or 3 descriptions- see chart below for descriptions and state requirements.
- Pedal or throttle assist. Try them out and see what you prefer.
- Capacity – enough to support you and your stuff - make sure all components can handle the weight.
- Geometry and suspension – comfort for long rides, not for single track or bunny hopping.
- Range – critical for longer rides; consider a range extender auxiliary battery.
- I asked Sal Cania of Omer and Bob's bike shop in Lebanon, NH what the most important things a prospective longer-distance e-biker should be considering. Without hesitation, he mentioned quality concerns, starting with ensuring that critical electric components-the motor and battery, are Underwriter's Laboratory (UL) certified or equivalent, and that the manufacturer has a good track record.

Sal recounted instances of bikes brought to them for repair that they are not able to work on due to insurance and safety concerns, and there are horror stories of fires with un-certified batteries.

Some other points:

- Exposed add-ons raise repair likelihood and cost: mirrors, electronics --keep it simple.
- Range extender batteries will add up to double the range at the expense of weight (about 10 pounds)
- Make sure warranty service is available and shops that will honor it are nearby.

WHAT'S THE GREENHOUSE GAS (GHG) IMPACT?

Manufacturing Emissions

Bike manufacturer Trek estimates that making one of their bikes generates 174 kilos (384 lbs.) of CO_2 equivalent GHG emissions.

Emissions produced manufacturing lithium ion batteries are notoriously hard to measure – an MIT study puts it at 30 to 200 kilos (66 and 441 lbs.) per 1,000 watt hour capacity. So, for a 600Wh e-bike battery figure 40 to 265 lbs.

Adding battery and bike production emission levels yields GHG manufacturing emissions for an e-bike between 423 and 678 lbs. Keep in mind that manufacturing a typical gasoline-powered car produces 5.6 tons of GHGs!

Operating Emissions

Recharging an e-bike battery uses about 600 watt hours of electricity. Nationally, generating 1,000 watt hours of electricity produces 0.86 lbs. of GHG emissions, so the electricity to charge an e-bike battery would generate about half a pound. In Vermont, where electricity generation produces nearly no GHG emissions, it's even lower.

A typical gas powered car emits about 0.8 pounds of CO_2 per mile, more than required for a 40 mile trip on a typical e-bike.

Riding an e-bike has cardiovascular health benefits for the rider as well!

Martin Wahl has worked in biofuels since 2006, currently with Lee Enterprises Consulting, a large bio-economy consulting group. Dividing his time between CA and NH, he serves on Corte Madera, CA's Climate Action Committee and is a Newfound Lake Region Association member. ♻

E-Bike Classes Explained

Characteristic	Class 1	Class 2	Class 3
When assisted	Pedal Assist	Throttle Assist	Pedal Assist-28mph
Motor 750 watt limit*	Works while pedaling only	Works at all times, pedaling or not	Works while pedaling only
Assists up to	20 mph	20 mph	28 mph*
Age limit	None	None	16 & older*
Helmets	16 and under	16 and under	16 and under*
Where allowed	Road & Trail	Road & Trail	Road Only*

***E-bike State Law Differences**

New York:
- Helmets are required for all Class 3 e-bike riders.
- Maximum speed for Class 3 e-bikes is 25 mph.
- Note that some laws are written in ways that seem arbitrary and unenforceable: E-bikes are allowed only on roads with speed limits 30 mph or lower, and Class 3s only in cities with populations of a million or more.

Vermont: E-bike motors may be up to 1,000 watts; in other states the limit is 750.

New Hampshire: Currently has no laws differing from the generic, however there is proposed legislation, House Bill 1447, that may result in significant changes.

Maine: A person under 16 years of age may be a passenger on a Class 3 e-bike only if it is designed to accommodate passengers.

Charging an EV is Cheaper

Cont'd from p.1

deal in Washington because gasoline is over $4 per gallon, making EV charging less than one-quarter of the price of gasoline.

Hawaii and California have relatively expensive electricity prices, so charging an EV in those states costs considerably more than in other parts of the country. On the other hand, gasoline is pricey in those locations, too, so EVs still end up being cheaper to fuel.

Some details behind the math

- These comparisons were made by calculating a "gallon-equivalent" for electric vehicles. This number is based on three factors: the average kilowatt-hour per mile to drive an EV, the average miles per gallon for a comparable gasoline-powered vehicle, and the price of electricity. Multiplying these three numbers together yields the cost of driving an EV the same distance as a traditional car would travel on one gallon of gasoline. The U.S. Department of Energy calls this number the "eGallon" and, for those interested, walks through the *math*.
- The car used for the comparison is the Hyundai Kona, which conveniently comes with either a gasoline engine or an electric drivetrain. Fuel economy data for both the *gasoline* and *electric* Konas are from FuelEconomy.gov. A comparison of the electric and gasoline models of the Ford F-150 pickup truck produced similar results.
- The cost for charging an EV depends on the price of electricity. The Energy Information Administration tracks the average *residential price of electricity* in each state. Gasoline prices fluctuate more rapidly and by a larger margin than electricity rates, so the basis of comparison between the two types of vehicles is ever-changing.
- Several utility companies offer discounted EV charging during off-peak times, and of course, charging an EV with one's own solar panels is free. Those variables are not captured in this map.
- Public charging is usually more expensive than charging at home, and costs also vary with location, time of day, charging speed and free or discounted rates offered by some car manufacturers. To keep things simple, and because most EV owners charge at home, this analysis only uses home charging for the comparison.

Read about the prices EVs and gasoline in *Driving with electricity is much cheaper than with gasoline*. Note that gasoline was $4.67/gal. when that article was written.

Karin Kirk is a geologist and freelance writer with a background in climate education.

This article by Yale Climate Connections *is published here as part of the global journalism collaboration* Covering Climate Now. ♻

Meet Your Solar Installer: ReVision Energy

George Harvey

It seems that hardly an issue of *Green Energy Times* goes to press without some mention of ReVision Energy. That is only partly because ReVision is one of the largest solar installers in New England. The company is also a prominent leader in more issues than solar-powered energy and resilience.

ReVision Energy was formed in 2003 by people who all wanted to make the world a better place. They did not set out to grow big, like other companies, but to give quality products to customers and let growth take care of itself. ReVision also became a Certified B-Corp in 2015. It says at its website, "As a B Corp, we are challenging ourselves to build a better world."

Maineri home, complete with ground-mounted solar. (Images courtesy of ReVision Energy)

The owners' next step must have come in stealth mode. Its employees were surprised when they were told in 2017 that ReVision Energy had become 100% employee-owned. And in 2020, ReVision Energy co-owners formed their pillars of justice, equity, diversity, and inclusion. Readers may wish to browse them at *https://bit.ly/ReVision_JEDI*. ReVision's guiding values are, "Be kind. Be responsible. Be excellent. Be clear. Be curious." *(https://bit.ly/ReVision_values)*

In a time of rapid expansion of demand for solar installers and technicians, ReVision trains its own employees. It runs a four-year paid electric apprenticeship program along with apprenticeships in design, sales, and customer support. ReVision's support for employees has paid off with employee loyalty.

ReVision Energy has five offices, two in Maine, two in New Hampshire, and one in Massachusetts, though it is soon to have a second office in Massachusetts. It also does business in Vermont. It offers solar energy for homes, businesses, municipalities, and non-profits, offering charging stations for electric vehicles, backup batteries, water heating, heat pumps, and community solar systems. In addition, it offers customers help in finding financing.

With ReVision's five offices, it employs about 400 people. So far, ReVision has completed over 15,000 installations. The October 2023 issue of *G.E.T.* had an article, "IRA Incentive Programs Make Solar Possible for Non-Profit Organizations," which included a discussion about converting St. Andrew's Episcopal Church in New London, New Hampshire, to solar power. Many churches now qualify for direct funding, as a result of the Inflation Reduction Act, and ReVision Energy knows how to help with that.

One good example of a customer is in New Hampton, New Hampshire. Francis and Karen Maineri decided to make their home all-electric, powered as much as possible by the sun. That meant heat, cooling, hot water, and battery backup, along with the usual electric devices and appliances.

The Maineri household was heavily dependent on propane, which fueled their heating system, dryer, and stove. The propane also powered a generator, in case the power grid went out. With the dependence they had on fossil fuels and grid electricity, they wanted to change as completely as possible to solar power.

The conversion was handled entirely by ReVision Energy. Their electricity now comes from a 9.5-kilowatt ground-mounted array. It supplies power to new heat pumps for heating and cooling. It also supplies power for appliances. A pellet stove and the generator were retained, in case they were needed, but a year after solar installation there had not yet been a need. The Maineris have lived through three grid outages and say the thing that made them notice the outage was the sound of neighbors' generators starting up.

Maineri ground mounted solar system.

They are still grid-tied, but they are supplying electricity to the grid most of the time. "I've been tracking costs through the Eversource bills we get every month," says Francis Maineri. "I'm unbelievably pleased by always having a negative amount. … I'm really happy with the way that has worked out."

ReVision has received honors. But Phil Coupe, one of the four co-founders, commented on this when he was asked why ReVision decided to become a B-Corp. "Imagine if every company were operating for the benefit for human kind and the planet."

We should mention that ReVision Energy has started a community solar program for New Hampshire that is similar to its successful program in Maine. We expect to cover that in our next issue.

ReVision Energy's website is *https://www.revisionenergy.com/*. ♻

Municipal Solar in a Rural Small Town, Windham, Vermont

George Harvey

When someone familiar with rural Vermont thinks of a small community, the image that comes to mind might be very like the town of Windham. It is not the smallest town, as several Vermont towns are smaller, but small size is a feature that might come up in people's imaginations. With a population below 450, nestled in the mountains, it might have all the charm, all the glorious countryside, and all the inconvenience, of what it is.

Windham could be regarded as representative of a certain type of Vermont town, even of some with populations five or six times as large. What applies to Windham might just as easily apply to almost any of them. Certainly, that is true of the installation of solar panels on the town's municipal office building.

Above: Old Meeting House, *now powered by solar. (Doug Kerr, Wikimedia Commons, CC-BY-SA 2.0) Left: Solar array on the Windham municipal office building. (Courtesy photo)*

The American Rescue Plan Act (ARPA)

On March 11, 2021, President Joe Biden signed the American Rescue Plan Act (ARPA) to help towns recover from the economic slowdown of the pandemic. In Windham, this meant that volunteers started meeting to work out how they would spend the $118,380 that was coming to the town. When they started out, there were about as many ideas about how to use the funds as there were people thinking of them. They drew up a list of ideas and went through several iterations of finding what most people might think the best use would be. Ultimately, they decided to present residents with a package that used much of the ARPA funds, along with other incentives, to put a solar array on the roof of the Windham town office building.

The town decided to build a town solar array that would cover the electricity use of three town buildings. These are the town office building, the old meeting house, and the town garage. One of these, the meeting house, is of historic significance, having been built over a span from 1802 to 1825.

The array was installed on the roof of the town office building, which is made with standing seam metal.

A well-known Installer

The installer is well known to regular *Green Energy Times* readers: Southern Vermont Solar (SVS), in Westminster, Vermont. Several weeks back, they finished the array, and we can report that it is working as planned.

The solar array has 39 Hanwha Q Cells, each of 405 kilowatts (kW), with 39 Enphase microinverters. The total is 15.8 kW (DC), which is converted to 13.61 kW (AC). The annual production of the solar system is expected to be 20,760 kilowatt-hours (kWh). The town's average electric bill was $212.77, but this has been covered by $335.48 of solar savings, meaning that the energy used is offset 187.57%. Clearly, the town of Windham will be generating more electricity than it uses by a fair margin, and some or all of this could be used in the future by using heat pumps instead of old-fashioned fossil fuels.

With all the incentives and grants, including

Cont'd on p.15

Solar Farms, Agrivoltaics and the Saffron Project

George Harvey

Farmers must work hard. People accept that to the point that it seems almost legendary. Farmers have to live with the realities of drought, floods, infestations of pests, late frosts in the spring, and early frosts in the fall, among other things. It is not an easy life, and increasingly, family farmers are closing their operations down and going into other lines of work. It is not necessarily what they want to do, but it is sometimes what they feel they must do.

Harvest with standard agricultural equipment operating between rows of solar panels. (Courtesy photo)

The times have brought several things that can give farmers some relief. In many places, they can lease parts of their farms to developers of renewable energy, bringing in much-needed cash, often enough for them to keep on farming. In some cases, they can develop their own renewable energy systems on their land.

Some people who object to this, taking the view that farm land should be only be used for farming. Forcing farmers to live by such a rule can put some of them out of business. When that happens, the land might, over the course of decades, revert to a natural state. Or it might be developed for some other purpose. Maybe that would be housing or industry. Based on what we see, however, it seems unlikely that it will be retained for farming.

In August 2018, *Green Energy Times* carried a story called "Saffron and Solar Farms," by Dr. Margaret Skinner a research professor at the University of Vermont. Her areas of expertise are Integrated Pest Management, Biological Control, Insect Pest Identification, and, interestingly Saffron Production. She and her colleagues had been looking into crops that could increase the incomes of farmers in Vermont, testing them to see whether they would thrive in the state's climate and soils. One crop they had looked into is saffron, a spice that can bring prices of $5,000 or more per pound.

By 2018, they had come to the conclusion that Vermont farmers would be able to grow saffron for profit, and they were looking at the question of how to use the land to best advantage, because it seemed unlikely that saffron would be mono-cropped on a farm in the state. With the help of Peck Solar, they grew saffron between rows of solar panels. That was the state of things when Skinner wrote her article in August 2018.

The research has gone on from there, and we can report on how it is doing. Early attempts to use standard solar arrays were not uniformly successful, partly because saffron doesn't grow well in heavy clay soils, where their first trial took place. In more favorable growing conditions, saffron grew well in and around the fixed-angle arrays. Peck Solar, which provided the solar system site, suggested that two-sided vertically positioned solar panels made by Next2Sun, a German company, could be used to greater advantage for agrivoltaics. We might remind readers that Peck Solar took the name iSun in 2021.

Dr. Skinner works with two others on the current agrivoltaic research. One is Dr. Bruce Parker, also a professor at UVM, whose areas of focus include Entomology, Integrated Pest Management, and International Agriculture. The other is Laura Eckman, a PhD student interested in Agriculture and Entomology.

The thing that makes the difference with the Next2Sun panels is that they can be installed vertically on a north-south axis. That way, the panels will get the sunshine in the morning and in the afternoon. They can outproduce conventional, fixed-angle arrays in early and late hours, losing a bit of production around noon. But there is more to the advantage.

Because the panels are vertical, they cover very little land (only around 4 inches), and even that land is not necessarily taken out of production. The current research project has solar arrays in lines thirty feet apart, with each line consisting of two panels, one above the other.

Crops that will be planted next summer include beets and carrots, primarily because they are standard crops in Vermont. The lines of photovoltaic panels have some areas where the lower part of the row has no panel, and tall crops such as peas can be planted in those areas. And space will be reserved for trialing saffron, because of its high commercial value. Obviously, other crops can be included in such a scheme, but this is a limited pilot test.

The land, with such a layout, can be nearly 100% devoted to agricultural production. Most of the crops can be raised just as they otherwise would be. Saffron does require hand work, in planting, weeding, and harvesting. On the other hand, it can be a very worthwhile crop. Also, since saffron corms are perennial, a single planting should last for years.

iSun gave some thought to the details of the installation, also. Care has been taken not to use concrete to support the panels. Instead, stakes are driven into the ground to support them, deeply enough that they should not yield to any wind that might be anticipated. An advantage of this is that the array has minimal long term negative impact on the land, and the system can be taken down to be moved to another layout or location.

iSun is fully supporting the installation and operation of this project with the expectation that it will develop expertise that can benefit Vermont's farmers. The University of Vermont is giving use of the land and there is support from the UVM Horticultural Research and Education Center. Major funding is provided by the USDA Northeast Sustainable Agriculture Research and Education Program *(https://northeast.sare.org)*.

Dr. Skinner said of this, "It's really exciting and appropriate for us because it is a solution to keeping agricultural land operating." Farmers can still be farmers, and that is important. Demonstration events are anticipated once the vertical array is in full operation.

For more information, contact: Bruce L. Parker, bparker@uvm.edu; Margaret Skinner, mskinner@uvm.edu; or Laura Eckman, leckman@uvm.edu. ♻

An agrivoltaic solar-wind farm in Europe during the winter. (Nex2Sun)

Saffron crocuses blooming in a raised bed within a solar array in New Haven, VT. (A. Ghalehgolabbehbahani, UVM)

Pitney Meadows Community Farm Demonstrates Our Sustainable Future Is Today

"This is the world we can build. We can address climate change alongside other issues. It's not going to cost you a ton of money. It might save you money. We'll have cleaner air. We'll have more energy security." – Dr. Hannah Ritchie

Mike Bailey

Over 166 acres in the heart of Saratoga Springs, New York – and seven years after it harvested its first lettuce, kale, and beans – Pitney Meadows is proving itself anew as the very model of an energy-smart, sustainable farm.

The quote above, from a *NY Times* interview of University of Oxford researcher Dr. Hannah Ritchie promoting a positive narrative of the future, could have been about Pitney Meadows Farm. Like Dr. Ritchie's views about sustainability in food supply, agriculture, energy, and environment, its mission is to celebrate and explore agricultural education, healthy food production, and recreation.

The Farm offers many ways to engage with both the land and other members of the community. That includes more than 100 plots and the support of an on-site garden manager for its Community Garden, CSA memberships where you can pick, taste, and learn to cook new varieties of vegetables, a farm store open dawn to dusk seven days a week, and an accessible trail system that circles the farm for walkers, runners, bikers, and dogs on leashes.

High Peaks Solar designed and built a 34-kW photovoltaic system, with 36 kilowatts of inverter capacity and 148 kWh of battery storage, working with the Farm and its builders on the placement of its new pole barn to maximize energy production. (High Peaks Solar)

"We view our farm and everything we do here as an educational opportunity," said Executive Director Brooke McConnell.

The Farm also strengthens the community through its Food Sovereignty Program. This program includes the donation of about 40% of all crops grown to a collaborative of local community-based organizations serving individuals and families facing food insecurity. That translates to about 100,000 servings of nutrient-dense produce annually to food pantries and other social service organizations in the region.

In addition, the program includes its Sovereign Gardens Initiative, which empowers local organizations serving food insecure individuals to develop and maintain on-site gardens. This program aims to create a lasting impact on the resiliency of the local food system, providing access to fresh, whole foods that can have a direct impact on health, economic prospects, and educational outcomes. Through its NutritionRx program with the Saratoga Community Health Center, healthcare providers give patients struggling with chronic diseases the nutrient-dense produce and culinary education they need to improve its health.

McConnell said, "As a mission-driven nonprofit organization, we are able to dedicate funds to innovations in farming practices, models, and demonstrations. We invite farmers in the region to learn more about our solar project and its potential viability on its land and with its operation. We're happy to share our resources and knowledge about the process."

Everything Grows Better with Sunlight

Only one section of the Pitney Meadows property is connected to the electric grid, leaving much of the farming operations area dependent on several large gasoline powered generators to provide power to seven large surface pumps for the irrigation of four high tunnels and all the acreage of cropped land.

At odds with its sustainability goals, the leadership of Pitney Meadows saw solar panels as just another way to harvest the clean energy of the sun to grow its community farm and the essential programs the staff and volunteers provide. The Board of Directors decided to move forward with an off-grid PV installation and the City of Saratoga Springs provided the initial investment with a $150,000 grant towards the solar array. High Peaks Solar designed and built a 34-kW photovoltaic system, with 36 kilowatts of inverter capacity and 148 kWh of battery storage, working with the Farm and its builders on the placement of its new pole barn to maximize energy production. The system allows for expansion of the dedicated wash pack facility and additional pumps for increased acreage production in the future.

With the renewable energy system eliminating noise and emissions from the generators, the working conditions have greatly improved for the farm team. According to Farm Manager Ian Magnus, "The evolution of solar power has made it more attractive to small farms as a practical option for running essential field equipment such as well pumps and greenhouses."

A Bright Future

The Farm's strategic plan will take several years, many volunteer hours, and generous donations from individuals, foundations, and businesses to fully implement. Under the direction of Brooke McConnell, they continue to grow and develop new programs, creating a dynamic, inclusive, and resilient community that thrives on a shared commitment to the well-being of the environment and each other.

"We are committed to being good stewards of the land and serving the community that invested its own tax dollars to preserve the Farm as open space. Together, we seek innovative ways to not only sustain our agricultural endeavors but to also sow the seeds of a more vibrant, compassionate, and interconnected community."

With its cherished farm landscape, cluster of rustic gray barns, large open farm field, and acres of woodlands and wetlands, the Pitney Meadows Community Farm is alive with creativity and active engagement, offering a productive and joyful place for volunteers, employees, and visitors. They will certainly remain a key part of Saratoga Springs for generations to come.

Pitney Meadows Community Farm is located at 223 West Avenue, Saratoga Springs, NY. Its website is *www.pitneymeadowscommunityfarm.org*. The farm can be reached at (518) 290-0008 or *contact@pitneymeadows.org*.

Mike Bailey is a sustainable energy consultant and a trustee of SolarFest, Inc. ♻

Growing good food and great community (Pitney Meadows Community Farm)

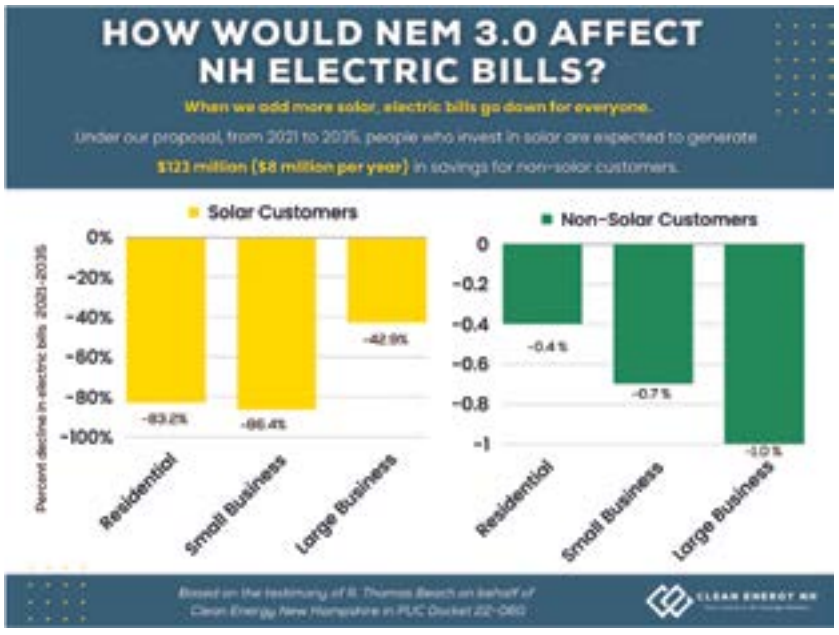
Local Renewables Lower Electric Rates For All Granite Staters

Sam Evans-Brown

A new analysis by Clean Energy New Hampshire shows that allowing homeowners to sell excess electricity from solar panels back to the grid through the policy known as "net metering" decreases electric rates even for people who don't own solar. According to the testimony of Tom Beach of Crossborder Energy, the avoided system costs that result from deploying local small-scale renewable energy generation substantially outweigh the costs of net-metering, which means the Granite State could afford to pay solar customers more for their generation, and still reduce non-solar customers' electric bills by an average of $8 million a year.

For context, later this year the New Hampshire's Public Utilities Commission (PUC), will decide how much those who generate local renewable electricity should be compensated for the energy they export to grid. This decision will occur in PUC Docket No. DE 22-060, and a negative decision could put solar out of reach for many Granite Staters, hurting both our economy and environment. In that proceeding Clean Energy NH is proposing an expansion of the current net-energy metering (NEM) credit issued to New Hampshire residents, businesses, cities and towns for the clean energy they generate. Our proposal is a modest increase of the NEM rate for residential customers that would amount to about a 2.5 cent per kWh increase.

To support this position, our careful review and re-analysis of *a study sponsored by the State of NH* upends the often repeated—but never quantified—claim that when more people invest in solar, electricity rates rise for everyone else. It shows our proposal will continue to lower electric bills, while catalyzing further investment in solar by homeowners, local governments, and businesses to pursue energy self-reliance and financial security. Under our proposal, non-solar customers in Eversource service territory alone would save $123 million between 2021 and 2035.



CENH's proposed net metering rate would add compensation for an additional 50% of the distribution rate for small generators (<100kW) and 50% of the transmission rate and 50% of the distribution rate for large generators (>100kW). These changes would result in improved economics for local solar, and would still result in $8 million dollars of savings per year for non-solar customers.

"Net-Energy Metering" is a mechanism that for decades has been the bedrock of the economics that allow homeowners, municipalities, and businesses to install solar. For each kilowatt hour (kWh) of extra electricity that the small generators produced, they would receive a credit on their account. This credit ensures that small and mid-sized solar generators get fair value for their energy and investment.

Previously, solar customers received a credit that was equal to the full retail rate for a kWh of electricity, but following a decision by the public utilities commission in 2017 *that rate was decreased* because of concerns that net-metering would increase electric rates for those who don't have solar panels. Critics of solar have claimed that the credits for excess solar energy generation represent a "cost shift" to electric customers who don't own solar. These critics claimed that when solar customers reduce their bill, non-solar customers have to pick up the slack and pay for the fixed costs of the electric grid. The previous rate is now referred to as NEM 1.0, and the current rate is called NEM 2.0.

However, our analysis shows that when your neighbors buy solar panels, you also experience a reduction in your bill, even if you never "go solar." This is because locally generated electricity reduces the overall cost of the electric system as a whole by:

- Avoiding purchasing expensive electricity and capacity from large power plants during expensive times of year;
- Wasting large amounts of electricity by transmitting it from far away; and
- Avoiding the need to upgrade local electric infrastructure resulting from generating more electricity close to where it is consumed.

Based on this analysis, CENH is recommending that NEM 3.0 should modestly increase the compensation that solar customers receive for their excess generation. The CENH proposal will improve the economics of distributed generation, which will mean more investments in local renewable energy generation, allowing the industry to grow at a sustainable rate.

Read CENH's full testimony in the net metering docket: *https://bit.ly/NHPUC-DavidLittellTestimony* and *https://bit.ly/NHPUC-TomBeachTestimony*.

Sam Evans-Brown is the executive director of Clean Energy New Hampshire. He was an energy and climate journalist for ten years before transitioning to the policy arena. ♻

Community Power Coalition of New Hampshire Offers Lowest Rates for Third Consecutive Period

The Community Power Coalition of New Hampshire (CPCNH) has announced a significant drop in its base electric rate for spring 2024. Member communities will see a 26% reduction in its base electric rate to 8.1¢ per kilowatt-hour (kWh). This marks the third consecutive rate period in which CPCNH has offered the lowest residential energy supply rates in the state.

CPCNH has transformed New Hampshire's energy scene since it launched service in April 2023. Its mission is to empower communities to take control of their energy future, reduce electricity rates and provide for more consumer energy options. By launching and operating Community Power Aggregation (CPA) programs, it gives communities more local control over both rates and energy sources. Already it represents 30% of New Hampshire's population, with more than 50 members serving almost 60 communities, and more lining up to come on board.

"In the first seven months of the program, there has been about eight million dollars of electric bill savings remaining in the pockets of Granite Staters," said Henry Herndon, the Director of Member Services. "And we're going to see these numbers really grow as more and more towns come online."

The Coalition offers several key advantages over competing models from utility- or broker- administered default supply:

- Its active portfolio management of wholesale power contracts enables the flexibility to respond to changing market conditions.
- It has a locally controlled and transparent process for setting rates
- Because it is a nonprofit, net revenues are deposited into financial reserve accounts to ensure long-term stability and benefits for member communities.

Savings That Speak Volumes

CPCNH's new rates, effective from February 2024, position the Coalition as a frontrunner in the competitive electricity market. The savings offered are nothing short of impressive – 24% off Unitil's residential rate, 20% off NH Electric Co-op's, 17% off Liberty's, and 2% off Eversource's. Even though Eversource Default Energy Service customers benefit from a reconciliation credit, CPCNH outperforms its rates.

Brian Callnan, CEO of CPCNH, expressed enthusiasm about the cost-saving options, stating, "We are thrilled to once again offer millions of dollars in savings to our customers. We continue to strive toward offering greater community control, customer choice, and the best electric rate possible for our growing list of member communities."

In addition to cost savings, CPCNH remains dedicated to fostering environmental sustainability and community empowerment. The Coalition provides customers with the opportunity to choose between 100%, 50%, and 33% renewable power options, all at rates comparable to Unitil, Eversource, and Liberty base rates.

Expanding Horizons

CPCNH's growth trajectory is remarkable. In March, twelve more "Wave 2" communities will join the Coalition, making it the second-largest electrical supplier in New Hampshire. The town of Durham will be one of these communities. "We're very excited to be moving to launch Durham Community Power for the benefit of our residents and businesses," said Durham Town Administrator Todd Selig in a statement. Selig highlighted the rate benefits for this cycle, and green energy benefits to come: "In future cycles, we are hopeful to be able to also provide a higher percentage of green renewable energy mix as a default, but that will be price dependent."

Last October, Cheshire County became the first county Community Power member in New Hampshire. The adoption of this county membership helps towns in Cheshire County adopt Community Power quicker by allowing towns to decide to use the County Community Power Aggregation rather than develop their own. This "fast track" approach helps get the benefits of Community Power to Cheshire County residents faster.

"We are thrilled to be able to bring this increased control and cost savings to our county government. Offering a "fast track" approach for the city and towns in our County, will also allow them to enjoy the extensive benefits of Community Power in a simple and straightforward manner," explained Cheshire County Commissioner Terry Clark.

The Towns of Dublin, Fitzwilliam, Nelson and Roxbury were the first to join Cheshire Community Power with others expected to soon follow.

Community Power Coalition of New Hampshire continues to show the possibilities of affordable and sustainable energy options for communities across New Hampshire. As CPCNH continues to expand and innovate, the positive impacts of community-led energy initiatives will continue to serve as a model of success for New Hampshire. ♻

NH Seeks IRA Grant to Help Low-income Residents Tap the Benefits of Solar

The State of New Hampshire is seeking $70 million in federal funding and partnering with housing advocates hoping to expand access to solar power for low- and moderate-income residents.

Sarah Shemkus

New Hampshire's Department of Energy has requested a $70 million federal grant to expand community solar programs for low-income residents, an infusion of funds that supporters said could lower energy bills, accelerate decarbonization, and perhaps even catalyze the development of much-needed affordable housing.

"It's just going to be life-changing for the communities we do this with," said Jeannie Oliver, a senior director at the New Hampshire Community Loan Fund, which partnered with the state on the proposal.

The request is part of the Environmental Protection Agency's Solar for All competitive grant program, created under the umbrella of the 2022 Inflation Reduction Act. The goal of the $7 billion program is to increase access to solar for people living in low-income and disadvantaged communities. Up to 60 grants will be awarded.

Community solar is a model in which energy consumers own a stake in, or subscribe to, a share of output from a solar development. They then receive credits for a portion of the power sold back to the grid, offsetting their utility bill. Community solar is often considered an option for consumers who can't or don't want to install solar on their own home, but who still want to participate in the environmental or financial benefits of renewable energy.

New Hampshire authorized community solar in 2013, but it hasn't gotten much traction. In the state, larger, non-municipal solar projects are credited only for generation on projects up to 1 megawatt in capacity. At that size, however, the finances just don't work for developers, said Sam Evans-Brown, executive director of the nonprofit Clean Energy New Hampshire. It's not until an array reaches around 3 megawatts – with net metering – that the economics start to make sense.

Reaching lower-income residents with community solar is even trickier. There are no easily available lists of what households qualify as low- or moderate-income, so acquiring customers can be prohibitively difficult.

An influx of federal money could change that equation. The grant money would be used to expand the existing program and to create new ones targeting affordable housing and resident-owned manufactured housing communities. The proposal calls for funding to be split between the state energy department, the New Hampshire Community Loan Fund, and New Hampshire Housing.

Meeting people where they are

If the grant is awarded, these partnerships will be key to maximizing the impact the funds can have on low- and moderate-income residents, said Joshua Elliott, director of the division of policy and programs at the New Hampshire Department of Energy.

"It made sense to leverage existing relationships," he said. "We thought meeting people where they are rather than having them come to us whenever possible would make for an attractive proposal."

The portion of the money going to the state energy department would be used to expand the existing program for low- to moderate-income community solar. The program will fund some of the project if a majority of the power generated benefits low-income households and up to 100 percent of a new development if at least 80 percent of the participating households qualify as low-income.

This solar project at the Mascoma Meadows manufactured home cooperative in Lebanon, New Hampshire is an example of the type of project that could get a boost from federal funding. (ReVision Energy)

The state program has awarded $1 million each of the last two years. Last year, it funded four developments with a total of 61 households participating. More money could help both by funding more projects, and making it easier for potential developers to plan, Elliott said.

"Having additional funding available consistently helps these organizations as they are trying to sketch out a project and figure out if it works," Elliott said.

The Community Loan Fund's portion would be used to help resident-owned manufactured home communities build solar arrays to service residents. A resident-owned community is a manufactured home park in which the residents have come together as in a cooperative to buy the land on which their homes sit, creating for themselves a more stable housing future.

The community loan fund has been working on developing community solar with these groups since 2018 when it led the creation of an array in the western New Hampshire city of Lebanon. Today, they have four projects either in operation or under construction.

"The reason that has been slow is that the financial barriers to low-income solar are pretty immense," said Oliver, who leads the organization's resident-owned communities' program. "What the Solar for All program would do is really help us scale up."

The remaining money would flow through New Hampshire Housing, a public corporation that promotes housing affordability and access throughout the state. It already works closely with the state's 18 public housing authorities, so it has relationships and experience with the low-income population the funded programs would be targeting.

Giving landlords a carrot

Much of the New Hampshire Housing money would be used to connect renters in multifamily buildings with community solar.

Traditionally, bringing solar to renters has been difficult because of what is often called the split incentive – if tenants pay their own electricity bills, landlords have little motivation to spend money on solar panels when the renters will reap the financial benefits. The grant proposal would encourage landlords to take over tenants' utility bills, and roll the cost into the rent, reflecting the discounts community solar would create.

"The Solar for All proposal takes a huge step in moving things in a more positive direction," Evans-Brown said. "It's giving landlords a carrot to figure this out."

The EPA should be announcing the grant recipients in March 2024 and distributing the funds in July, Evans-Brown said. Solar projects using the money should start popping up by 2025.

If New Hampshire receives the grant, it could be transformative, supporters said, by both accelerating the state's decarbonization efforts and making a significant difference for financially struggling households. In concert with other federal programs pouring money into home electrification and energy efficiency, the Solar for All funds could jumpstart significant and much-needed growth in green housing development, Evans-Brown said.

"The thing I am excited about is this influx of money is going to result in a large amount of multifamily, sustainable housing getting built that's going to be really affordable," Evans-Brown said. "I am really optimistic."

Sarah Shemkus is a longtime journalist who covers business, technology, sustainability, and the places they all meet. Her work has appeared in the Guardian, *the* Boston Globe, TheAtlantic.com, *and* Slate. *Based in Gloucester, Sarah covers New England.*

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Solar in Your Community

Cont'd from p.1

lowered to 0.5, meaning that $0.50 was charged for each $1,000 of property value.

Clearly a tax rate so low is not sustainable; the town must pay its bills, too. When the rate returned to normal this year, it was a shock to see the rate return to the more usual 4.6, or $4.60 per $1,000 of value. The Deputy Town Supervisor, Anita Clayton, pointed out that the new rate was still low, although local media had reported there was to be an increase of 800%. Truth be told, 800% of a dime is still less than a dollar.

Town of Berne, NY, an example for siting solar arrays

The town of Berne may have set the standard for siting solar arrays to other communities throughout the country. *North American Clean Energy* recently published an article outlining what the town accomplished as an example to help to accelerate the process (*https://bit.ly/NACE-effect*).

Understanding siting for solar

- First thing is an understanding of what the problems with siting solar arrays are. Siting happens most smoothly if the local regulations are clear and concise.
- Second, processing applications really needs to be given attention to make sure that permitting does not take excessive amounts of time.
- And third, the views and feelings of the local people who live near the proposed array site need to be taken into account as well as any possible environmental and agricultural impacts.

Examining the Land Prospects for the Town of Berne

With 2,695 people, it was determined that the town of Berne has 1,196 parcels of land with an average size of 21 acres. Looking at these, 910 parcels were found to

Beautiful pollinator habitat on a New York solar project. (Images: United Agrivoltaics)

be zoned in such a way that solar projects could possibly be built. Further restrictions and zoning regulations reduces that number to 302.

Of course, the limitations on what can be done do not end with zoning. The town has setback requirements that a solar array must be sited at least 200 feet from abutting property and more than 100 feet from wetlands, streams, ponds, lakes, or water wells. This further reduces the number of sites to 145. And for any of these to work, it must have 20 acres that can be used within a quarter mile of a feeder line, which reduces the number of suitable parcels to 28.

To determine that Berne has 28 parcels suitable for use for solar arrays could not have been an easy task. There was a fair amount of work that went into the process, but the result is that Berne is better prepared for the transition to clean energy.

The effects that a solar array can have on a community

When a solar array is built, it adds to the value of the land, which adds to the value of the tax base. But it does this in ways that are distinctly different from what might be done with other types of development, or choosing not to develop.

A solar array can increase grid stability as well.

There are many ways to develop land. Solar panels will add value to vacant land by increasing tax revenues. Unlike residential development, which requires money to be spent on schools and various services, a solar project does not require much from the town – perhaps nothing at all.

We should mention that a solar project can be combined with agriculture in a wide variety of ways. It happens that a solar company, TJA Clean Energy *(https://tja.energy/)* and United Agrivoltaics *(https://www.unitedagrivoltaics.com/)*, is already presenting proposals for a site on Switzkill Road, in Berne with agrivoltaic and pollinator site options. It also allows the adjoining property owner to continue to use the site for farming, where this solar array might be located. This is going through the approval process now.

Lowering Community Taxes

Community solar can do even more for the community. The town of Berne is in National Grid territory, and National Grid Renewables (NGR) is a subsidiary. That company is currently developing many more solar farms to the benefit of communities in its territory. *(https://nationalgridrenewables.com)*

New York's renewable energy goals are high and benefit our future with clean energy. There can be financial and health benefits. The cost of living can be reduced. It also assures reliable electricity for the community, especially if battery storage is included. Development of renewable energy in Berne could reduce taxes considerably in the same way that other communities have done when working with NGR.

In the December edition of *Green Energy Times*, we ran the article, "Solar Farms Produce Millions in Tax Revenues" *(https://bit.ly/Solar-and-taxes)*. That article shows how some communities can have taxes significantly reduced when solar arrays are built in them. Since the events in that article, NGR has completed more sites that have benefited communities in their territory in Kentucky. These communities are receiving millions of dollars in tax revenues. Berne is in NGR territory and could also benefit largely by working with NGR for more solar farms that produce millions of dollars in tax revenues. So could many other communities like Berne. Solar development does not create the problems of residential or commercial development.

As taxes go down, with any luck the question of local resilience could also be addressed. And remember, it is not just taxes. Solar can be a big part of the solution from the savings in taxes which could ultimately lower the cost of living and leave more money in the pockets for those living in the community. ♻

Caleb Scott, owner of UA, with Icelandic lamb born on solar farm in upstate NY.

Offshore Wind Power Moves Forward in NYS

George Harvey

The United States is finally starting to develop its offshore wind power. At the beginning of 2023, the country had seven offshore wind turbines, a tiny fraction of the numbers already built by other countries. Nevertheless, the momentum for the industry is growing, and that is especially true for New York, where Governor Kathy Hochul has been busy pushing offshore wind power.

Readers should understand that offshore wind turbines are gigantic. Their tower components and blades are far too long to transport on roads or by rail. Onshore wind turbines, with blades that must be trucked, are limited by size to about three megawatts (MW) capacity, but offshore wind turbine components can be transported by ship, and some are 15 MW, with blades over 115 meters (377 feet) long. And offshore turbine nacelles, which contain the generators, can be as big as a small house.

That brings us to New York. One of the state's great assets is the Hudson River. Ships and barges can travel up and down, and they can carry the long components of offshore wind turbines from as far north as Albany down to the sea at the New York Bight. Workers well inland can have jobs building towers, blades, and other components for offshore turbines.

Karp Strategies, LLC, did an analysis of the employment and business effects of building factories on the Hudson River to support offshore wind power. These consist of a tower making facility at the Port of Albany and facilities to make blades and nacelles at the Port of Coeymans, ten miles south of Albany.

The plant at the Port of Albany is being built to manufacture 150 towers per year. Construction is expected to cost $802 million to build and is already under way. The facility at Coeymans is expected to cost $800 million to $900 million and has been approved and is ready to build. Other investment in the area might mean construction investments could total $2.1 billion. It is expected that there will be over 7,500 construction jobs created, with over 2,000 related jobs, and these should continue for several years.

When the plants are in operation, they should employ 2,200 workers. That figure is the number of jobs at the plants themselves, making wind turbine components. There will be other jobs created to support the effort. Some of these are indirect, for example supplying source materials to the plants. Others jobs will be induced, including such things as food vendors supplying workers on the lunch breaks. Altogether, the wind farm construction could have as much as $5 billion in economic impacts in the New York capital region.

Of course, the investments and jobs all depend on the offshore wind farms being built. Over the past couple of months we have come across a number of stories saying that companies building wind farms of the East Coast of the United States were having troubles due to inflation or supply chain problems. Some projects have been canceled or reset, and that includes Empire 2. It was to come after Empire 1, which is now under construction.

The issues causing these problems certainly slow offshore wind development, but they are not expected to delay it for the long term. When an offshore project gets canceled, it is put out to bid again, and a company picks it up anew.

Construction of the wind farm itself means other facilities will be built. These may require their own studies, approvals, and permits, in varying venues. In December, the New York State Public Service Commission approved plans by Empire Offshore Wind, LLC for the offshore and onshore transmission facilities for the Empire 1 Offshore Wind Project. It is to run 17.5 miles of transmission lines through New York state waters to a connection point in Brooklyn.

As we can see, the activity relating to wind farms in the New York Bight is creating economic benefits far beyond reducing greenhouse gasses. ♻

Offshore wind. (AdobeStock/366215509)

Wind In the News

Offshore Wind Investment Hit An All-Time High in 2023

According to BloombergNEF's "Renewable Energy Investment Tracker 1H 2024," offshore wind investment surged to a new high in 2023 despite rising costs and interest rates. Global offshore wind investment reached a record $76.7 billion, jumping 79%.

This offset the 17% year-on-year decline from the onshore segment. China remained the largest offshore wind market, in spite of a down year, followed by the UK and the U.S.

BNEF predicts that governments will be willing to pay more for offshore wind and include more risk-sharing mechanisms in auction deals in 2024, while interest rates could also start to fall, decreasing the cost of borrowing. *https://bit.ly/Wind_investment*.

Bloomberg New Energy Finance, by Oliver Metcalfe, February 7, 2024 via Sun Day Campaign. ♻

More States Are Cutting Energy Bills for Low-income Households

Many households struggle to pay energy bills, but innovative policies that reduce energy burdens and accelerate an efficient and equitable transition from fossil fuels are catching on.

Mark Kresowik, ACEEE Senior Policy Director

Low-income households are often faced with the threat of disconnection from utility service, and painful choices between *affording energy* and other critical needs, harming the health and well-being of the most vulnerable. A growing movement to *reduce energy bills* for low-income households through policies like percentage-of-income payment programs (PIPP), along with energy-saving improvements, will lower energy burdens for the long term.

Most states have not focused energy efficiency efforts on underserved households, which has contributed to *insufficient funding* for helping them save energy, entrenching racial and social inequities. Before this year *only Virginia and New York* had explicit targets to reduce energy burdens through their energy efficiency requirements for utilities. And only Massachusetts, Pennsylvania, and Washington, DC, had set minimum energy savings targets for efficiency programs geared to serve low-income households. However, there have been some positive developments from state officials and regulators this year that have accelerated progress.

Directly limiting energy bills

In 2022 the New York Public Service Commission *forgave $567 million in energy bill debt for extremely low-income households*. In January the commission forgave an *additional $672 million* for low- to middle-income households and businesses that weren't included in last year's decision, made more than 800,000 additional households eligible for energy bill discount programs, and committed to an *Energy Affordability Guarantee*—essentially a PIPP—that limits energy bills for 20,000 low-income households to no more than 6% of their income. New York's *EmPower Plus* program, which further links debt forgiveness and income-based limits on energy bills together with energy efficiency and electrification investments, has created a compelling new model for advancing energy affordability across the country.

In Virginia a similar PIPP is *finally set to start enrolling customers next year*. The Virginia program was initially passed by the legislature in 2020 and is the first that explicitly requires pairing the electric bill caps with participation in energy efficiency programs. *Initial guidelines from the Virginia Department of Social Services* indicated that PIPP participants will automatically be eligible and signed up for an energy audit, provided information on Virginia's weatherization provider network and practical ways to reduce household energy use, and given resources on the use and maintenance of installed energy efficiency measures.

Jubilee Apartments in Washington D.C. provides low-income families with solar power and a resilience center. (Natasha Riddle)

Regulators in at least five other states have taken interim steps this year toward setting comparable policies for advancing energy equity. The Colorado Public Utilities Commission adopted an *energy affordability work plan* that includes easing enrollment in the state's PIPP, ending utility disconnections during extreme cold weather, and planning for an efficient and equitable electrification transition. The Wisconsin Public Service Commission investigated potential new energy affordability programs and *received dozens of comments*, most supporting a PIPP structure. The California Public Utilities Commission *adopted a set of principles* to evaluate proposed new rate designs from the state's utilities that will include *potential income-varying charges* that could function similarly to a PIPP.

The Maryland Public Service Commission *had asked for public comments* by the end of January on implementing programs to reduce energy burdens, including PIPPs. And in a truly *groundbreaking decision charting a future toward efficient electrification*, the Massachusetts Department of Public Utilities committed to a proceeding to address energy affordability in that transition. Two utilities in Massachusetts—*Unitil* and *National Grid*—have already proposed significant improvements to their rate discounts for the lowest-income households, reaching as high as 50–55%, a substantial increase from current levels of 30–35%.

Reducing energy costs for low-income households is critical, but it should be paired with energy efficiency improvements to ensure that households in marginalized communities are not left in inefficient, uncomfortable, and unsafe homes with needlessly high utility bills.

Ensuring efficiency programs serve low-income households

This year at least three states have added specific annual energy savings targets for programs supporting low-income households, a *critical step for further improvement*. The Virginia legislature set a modest requirement for the state's two largest investor-owned utilities to *meet a 1% cumulative annual energy savings target* for low-income households.

The Maryland legislature went further, *requiring an increase to a 1% incremental annual energy savings target* by 2026. Incremental savings demonstrate greater progress because they are one year of energy savings from measures implemented under programs in a given year, whereas cumulative savings are the savings from all the measures that have been implemented under the programs in that year and in prior years that are still saving energy. The Maryland Public Service Commission will *decide on a plan to meet that requirement* before the end of the year. But even those requirements, while admirable, should at minimum match the level of energy savings that the state requires utilities to meet for customers overall—*in Maryland those exceed 2%*. The Michigan legislature rose to that challenge by *setting a goal for energy waste reduction programs* serving low-income households to meet or exceed the savings levels of programs for all customers and requiring at least 25% of the spending to reach those households.

These states are demonstrating new ways to move toward a more efficient and equitable future that reduces energy burdens for low-income households as we transition off fossil fuels. But more improvements still need to be implemented, more states need to act, and overall progress toward energy equity must be accelerated. ♻

EXPANDING CLEAN, GEOTHERMAL ENERGY FOR ELECTRICITY

In support of President Biden's Investing in America agenda, the U.S. Department of Energy (DOE), announced the selection of three projects that will receive up to $60 million to demonstrate the efficacy and scalability of enhanced geothermal systems (EGS). Funded by the Bipartisan Infrastructure Law, the pilot projects will use innovative technology and a variety of development techniques to capture the earth's abundant heat resources. These projects will demonstrate the potential for geothermal energy to provide reliable, cost-effective electricity to tens of millions of U.S. homes and businesses and help deliver on the President's goal of 100% clean electricity by 2035. They also support the goals of DOE's Enhanced Geothermal Shot™, which seeks to cut the cost of EGS 90% in the same time period.

U.S. Secretary of Energy Jennifer M. Granholm said, "With significant investment from President Biden's Bipartisan Infrastructure Law, these pilot demonstrations will help us realize the full potential of the heat beneath our feet to reduce carbon emissions, create domestic jobs, and deliver clean, cost-effective, reliable energy to American nationwide." Read further at *https://bit.ly/DOE-geothermal*. ♻

Municipal Solar for Windham, VT

Cont'd from p.9

its part of the funds from ARPA, the net cost of Windham's solar system came to $31,777. In its system estimates, SVS estimated the return on investment will be 339.99% over 25 years, which is the minimum lifetime of the system. The internal rate of return of 13.99% per year indicates a payback period of 7.1 years. The levelized cost of the electricity is 18¢/kWh, an amount that will not vary with the price of oil, gas or grid electricity.

Southern Vermont Solar

Victoria Roberts, who owns SVS with her husband, Simon Piluski, gave her opinion of how the solar array came out. She said, "It is a beautiful, beautiful installation." We suspect she is not alone in this opinion. She also commented on the job, "Working with the town of Windham has been an awesome and rewarding collaboration. I am proud of this small, mighty Vermont-strong town for recognizing a golden opportunity and doing the work to make this renewable energy project happen. I have no doubt the Town of Windham will inspire surrounding towns to join the solar revolution."

Southern Vermont Solar's website is svtsolar.com. ♻

Green Mountain Enclosure Consulting, LLC, Bristol, Vermont

Interview with Nate Gusakov, Owner

G.E.T. *Staff*

Nate Gusakov of GMEC performs a blower test on a large building. (Courtesy photo)

G.E.T. What is your background?

Nate Gusakov.: I was born and raised in the town of Bristol in Addison County, VT. My parents' house is on the edge of Hogback Mountain -- the backyard goes up into thousands of acres of woods, and the front yard is sidewalk and village streets.

After high school, I dropped out of college twice (U.S. Coast Guard Academy and Whitman College) and traveled around the world. Eventually, I settled in at Sterling College in VT's Northeast Kingdom where I stayed for four years and earned degrees in Natural Resource Management and Sustainable Agriculture. My time at Sterling was formative, especially in terms of some core values around ecological awareness and environmental stewardship. I also got into the college's draft horse program. I graduated in 2006 with my degrees, a milk cow, and a Percheron horse.

I did some small-scale commercial farming after that but working as a carpenter was always what paid the bills, and that's what I stuck with professionally. In 2013, I was hired by Silver Maple Construction (SMC) as a crew carpenter. I worked there for over ten years until founding Green Mountain Enclosure Consulting in the spring of 2023.

What is the history of your businesses?

N.G.: Green Mountain Enclosure Consulting, LLC (GMEC) came into existence on April 1st, 2023, but my path towards building envelope work began through Silver Maple Construction (SMC) in 2017.

At SMC we were seeing an increased demand for blower-door testing and residential energy audits, so I was sent off for a week of training and received certificates from the Building Performance Institute (BPI). Consequently, I began performing residential energy auditing and weatherization work.

Then, in 2018, SMC started installing AeroBarrier (aerosolized building air-sealing technology). I was the most likely candidate to run that division, so for the next five years I did many AeroBarrier installations around Vermont and New England.

At the same time, I began receiving more inquiries about airtightness testing services for large commercial buildings. This led to SMC investing in more fans and equipment to meet this need. I was consequently capable to perform envelope assessments and compliance blower-door tests for the large commercial sector.

In 2022, I earned credentials as a Certified Commissioning Authority (CxA) and a Building Enclosure Commissioning Provider (BECxP) from the University of Wisconsin-Madison.

What is building enclosure commissioning?

N.G.: It is the process of 'minding' the building envelope of a construction project, right from the pre-design stage through final compliance testing and ensuring that what is actually built conforms to the original desires and requirements of the owner. It involves performing architectural design reviews, on-site progress testing (thermal imaging, theatrical fogging, etc.), and final blower-door testing when the building is completed, all with building durability and efficiency in mind.

In the spring of 2023, I decided to make the leap and started GMEC, and am keeping busy with BECx work and residential and commercial enclosure consulting.

One of the things I'm starting to specialize in is performing envelope assessments on existing large buildings. This refers to a lot of turn-of-the-century municipal brick buildings that are coming due for renovations (town offices, libraries, dorms). Usually this involves a blower-door test with IR imaging under depressurization, with a lot of guided diagnostics of current insulation and air leakage conditions. It is very important that we take good care of our existing building stock going forward. I really enjoy having a hand in helping to make careful, impactful decisions about how to weatherize and renovate these old, large buildings without doing un-intentional harm.

Another service that I offer and am really excited about is remote building envelope conditions monitoring through little Wi-Fi embedded sensors (see my article 'Clearing Up the Gray Areas' in the December 2023 issue of Green Energy Times (https://bit.ly/Gray-Areas). I also offer basic project embodied carbon calculations using the online BEAM tool.

Why did you chose to start your own business?

N.G.: There were many reasons for starting my own company -- I had been with SMC for a full decade, so in some ways it was a natural time for a change. I also was taking on more consulting work, and I wanted to separate myself from any specific products (e.g. AeroBarrier) and companies, in order to be able to function as a fully independent consultant. Finally, the BECx and consulting work that makes up my bread and butter of what I do now isn't really what SMC [did] I was taking things in my own direction. So it made sense to formalize that separation and go my own.

Do you still work for/with Silver Maple Construction or Aerobarrier?

N.G.: I'm no longer doing any AeroBarrier installation but I'm still collaborating happily and regularly with Silver Maple Construction. GMEC performs consulting and testing work for their projects.

Editors'note: As readers of Green Energy Times *would be aware, building efficiency is of prime importance to us. To help to achieve a low-carbon society, efficient buildings are needed as a top priority to achieve our goal to get our carbon emissions down. Nate Gusakov has been submitting his Building Science articles for* G.E.T. *for many years. His knowledge, background, training and experience make him a prime candidate to help all he consults with, to enable them to attain their own high-performance buildings. And in the end, the costs to operate efficient buildings will be so much more affordable.*

We wish Nate the very best of success with his new business model. ♻

The Evolution of a Sustainable Mushroom Farm

An interview by Sandra Stempel

Avery Stempel harvesting Golden Oysters in Wynantskill, NY.

Avery Stempel is a mushroom farmer, poet, philosopher, entrepreneur, artist and the face of Collar City Mushrooms in Troy, New York. His reach into the world is akin to a network of mycelium running miles under the forest landscapes. Continually reaching out to share his ever-expanding knowledge of the healing power of mushrooms.

What was the impetus landing Avery, feet running, in an indoor urban mushroom farm built from the ground up? Step inside 333 2nd Avenue in Troy, New York - home to Collar City Mushrooms - and enjoy the aura that is Avery Stempel.

SS: *You and your team have built an inviting space here at Collar City Mushrooms. The fireplace, fungi art, mushroom library, grow room viewings and all manner of mushroom products. What started you on this trajectory?*

AS: Thank you. I love sharing my story. Raised in the Helderberg Mountains in East Berne, New York, my roots are anchored in the forest. From the family sawmill business built by my grandparents, to forest visits with my dad as a youngster, the outdoor world's been my playground. Joining my dad, Brian Stempel, on log truck runs to the Catskill Mountains, my mom, Kathy, and I spent hours in the surrounding forest as Dad cut trees and readied them for transport to the mill.

This outdoor experience exploring the landscape of trees, lichen, rocks and fungi sealed my connection to the earth.

At our house, there were always chunks of wood around sporting mushroom growth. Dad's procurement of huge bracket mushrooms from the forest decorated our home. Having "sawdust in my blood" from our family sawmill business, I am now convinced mycelium is concurrently running through my veins. Mushrooms are just that cool.

SS: *Did you forage mushrooms as a child?*

AS: While I felt connected to the fungal world in my youth, foraging came later. After meeting my current partner, Amy Hood, we discovered a mutual love of all things fungi — especially after realizing both of our phones were filled with wild mushroom photos. Amy was already growing Shiitake mushrooms as a hobby. I happily partnered with her in this enterprise. It was great fun but thoughts of running a mushroom farm was a 'one of these days' pipedream.

SS: *During this time, you worked as front-end manager of EMPAC – the experimental performing arts center on the RPI campus.*

AS: Yes, that's right. I started there in 2008. In March of 2020 I was furloughed. It was devastating. My support network, however, is huge and with encouragement from my brother Nathan, my father and my band of mushroom enthusiasts, plans for full time mushroom farming bubbled to the surface. As ideas evolved and team members came on board, Collar City Mushrooms leapt from a collection of ideas to a brick-and-mortar storefront with our grand opening on March 11, 2021.

SS: *A rewarding day for you and your team, I'm sure.*

AS: Indeed! Starting a business from nothing is a tremendous lift. I'm thankful for the enormity of support from family and friends. Their encouragement, enthusiasm for our offerings and deep belief in what we are doing, ensures our continued growth and idea development.

SS: *What else goes on at Collar City Mushrooms, besides the farming piece?*

AS: Oh, my! The plate is so full. Featured artist events paired with social elements enjoying mushroom snacks and teas, artist intros and mingling, mushroom coloring books, shrooms and poetry, and mushroom card games. There are educational workshops, local garden club talks, library and classroom presentations. Also, homeschool visits and mushroom meditation sessions, as well as establishing and growing partnerships with local restaurants, catering businesses and educational institutes.

A recent undertaking was the creation of a mushroom experience and dinner at SPAC (Saratoga Performing Arts Center) this past year as part of their culinary arts program. It was over the top exciting.

Avery Stemple on a News Channel 10 newscast.

Counterclockwise: Blue Italian, Pink, and Golden Oyster mushroom; Chestnut mushrooms growing at Collar City Mushrooms; Bree Morehead and Amy Hood putting mushrooms into grow and packing orders. (Courtesy images)

SS: *If you could choose a superpower, what would it be?*

AS: I would choose the ability to increase compassion and empathy in people, leading to possible better understanding and implementation of sustainable living choices, reasonable compromises and more kindness.

SS: *You exude a clear passion for mushrooms. Why?*

AS: As a food source, they have low environmental impact, high nutritional content, sustainable production and a fast-growing cycle. They are protein rich, fiber full and nutrient dense. And, leftover grow blocks can be used as compost for soil rejuvenation. Mushrooms have been eaten and used medicinally for thousands of years.

SS: *You are a human mycelium as well as a poet. Please share a snippet of mushroom poetry. [Read it in the next column.]*

SS: *Where can we learn more about Collar City Mushrooms?*

AS: You can follow us on Facebook, Instagram and visit our website at www.collarcitymushrooms.com.

Sandra Stempel is Avery's aunt. Sandra and her brother Brian (Avery's dad) run the family sawmill started by their parents in the late 1950's. She works part time at the Berne Public Library in Berne, NY, volunteers for the Helderberg Ambulance Squad, and is the Town of Berne Historian. She has a passion for nature wanderings, cooking with mushrooms, writing, learning and quiet reflection. ♻

Finding Fungi

Suddenly you see it,
A splash of color,
A little rounded nub.
Just off the path,
You inhale sharply
Breath catching
Excitement filling your head.
You leave the well-worn trail
Strike out into the unknown.
On the hunt
One dollop of orange leads you
to a few splashes of red.
Next, some circled sproutings
of brown
Then on to a collection of tiny
white tubes
And finally, a series of wide
wedges extending from a
fallen tree.
Such joy in discovery.
Such elation while wandering.
Such pleasure in getting lost in
the woods.

— Avery Stempel

FEDERAL

FEDERAL INVESTMENT TAX CREDIT

- To learn more about federal tax credits for home owners, home builders, and commercial buildings:, go to: www.energystar.gov/about/federal_tax_credits.
- Learn more about electrification rebates and tax credits associated with the Inflation Reduction Act at https://www.rewiringamerica.org/app/ira-calculator.

USDA RURAL DEVELOPMENT PROGRAM

USDA Rural Development Program - Rural Energy for America (REAP)

- To see the USDA programs and services available in your state, visit https://www.rd.usda.gov/programs-services/all-programs.

Biorefinery Renewable Chemical, and Biobased Product Manufacturing Assistance Program

This program provides loan guarantees up to $250 million to assist in the development, construction, and retrofitting of new and emerging technologies. These technologies are: advanced biofuels, renewable chemicals and biobased products. For more information, visit https://bit.ly/usda_emerging_technologies_programs.

REGIONAL

The Grassroots Fund's Grant Programs

The grant program is designed to energize and nurture long term civic engagement in local initiatives that create and maintain healthy, just, safe and environmentally sustainable communities.

Three grant programs are offered:

- Seed grants are designed to support new (often less than 1 year old) environmental projects.
- Grow grants support initiatives that look to deepen their work or broaden participation.
- The Young Leaders program supports efforts with significant leadership by organizers under 25 years old.

Learn more at https://grassrootsfund.org/grant-programs

VERMONT

CLEAN ENERGY DEVELOPMENT FUND

The Small Scale RE Incentive Program, administered by Renewable Energy Resource Center (RERC), provides funds to help defray the costs for:

Advanced Wood Heating

Pellet systems = $6,000 per pellet boiler/furnace (in partnership with Efficiency Vermont). Commercial spaces over 5,000 sq. ft. may also be eligible for incentives.

- Up to $3000 voucher to purchase a pellet storage bin from a participating vendor - offered by the Clean Energy Development Fund. See *www.rerc-vt.org* or call (877) 888-7372.
- Coal Change-out adder. An additional $3,000 additional incentive for a pellet heating system if replacing a coal heating system. (www.RERC-VT.org) or call them at (877) 888-7372.
- Replace coal stove, furnace, or boiler with a pellet stove, furnace, or boiler
- Adder is up to $27,000 for commercial projects
- Can be combined with other incentives

(http://tax.vt.gov/exemptions)

- Additional information on wood heating at: www.fpr.vermont.gov/woodenergy/rebates

Free Assessments for Small Businesses

- FPR, in partnership with VEIC, is offering free assessments for Vermont small businesses interested in switching from fossil fuels for their heating needs to Advanced Wood Heat (AWH). For more information, contact Adam Sherman at VEIC at asherman@veic.org.

Bio-diesel

- Eligible customers can receive funds for heating with bio-diesel.

(www.rerc-vt.org/heating-with-biodiesel)

Other Utilities Heating Offers

- Members of Washington Electric Co-op (WEC) can get a $1000 rebate on approved pellet boilers and $500 for pellet furnaces. This can be combined with the CEDF and Efficiency Vermont incentives for a total of $7000; $250 for qualifying pellet or wood stove installed by a qualified installer. This can be added to stove offers from CEDF and Efficiency Vermont.
- Members of the Vermont Electric Co-op can get a $150 credit on the purchase of an approved pellet stove: www.vec/energy-programs.
- Stowe Electric Customers can get a $150 rebate with the purchase of a pellet stove.

VT TAX CREDITS

- Vermont offers an investment tax credit for installations of renewable energy equipment on business properties and wood and pellet heaters with at least 75% efficiency. The credit is equal to 24% of the "Vermont property portion" of the federal business energy tax credit.
- More info on the 2021 IRS Tax form at https://www.irs.gov/pub/irs-pdf/f3468.pdf.

Tier III programs

- Additional incentive offers may be available through your local utility provider, contact your utility for more information.

EFFICIENCY VERMONT

All incentives subject to availability, limits, and may change at any time. For complete details, and participating retailers/contractors, call 888-921-5990 or visit www.efficiencyvermont.com/rebates.

Lighting

- LEDs for indoor growing: $100 back for qualifying fixtures

Weatherization

- Comprehensive air sealing and insulation projects with an Efficiency Excellence Network contractor: 75% off eligible project costs, up to $4,000.
- DIY: $100 back for completing eligible projects, like weatherizing windows and doors, and sealing air leaks in your attic and basement.

Appliances (must be ENERGY STAR)

- Dehumidifiers: $25 - $40 rebate
- Combination washer/dryer rebate: $400
- Clothes Dryers: $200-$400 rebate

Heating/Cooling/Water Heating

- Central wood pellet boilers and furnaces: $6,000 rebate (in partnership with CEDF)
- Advanced pellet or cord wood stove: $400 discount at participating retailers for replacing an old stove.

Heat Pumps:

- Air-to-Water System: $1,000/ton rebate
- Ducted Systems: $1000-$2000 discount at participating distributors
- Ductless Heating & Cooling System: $350-$450 discount at participating distributors
- Ground Source Heat Pumps: up to $2,100/ton rebate
- Heat pump water heaters: $300-$600 discount at participating distributors;
- Moderate-income Vermonters are also eligible for bonus rebates up to $500 for heat pumps and heat pump water heaters.

- Window air conditioners: $100 for select ENERGY STAR Most Efficient models.
- Smart thermostats: up to $100 back for select ENERGY STAR models.
- Electric utility rebates may also be available.

Other Opportunities to Save

- ***Home Energy Loan*** – This loan offers income-eligible financing as low as 0% APR for 60 months. It is more accessible than traditional financing tools and can be used for small projects like a new pellet stove, or large projects like a weatherization project.
- Additional incentives may be available through your local electric utility provider. Contact your utility for more information.
- **On-bill financing:** Pay for your weatherization project on your monthly utility bill. Restrictions apply.
- **Renters can get free LEDs** (including dimmable and wifi-enabled), faucet aerators, and showerheads.
- **Small business wood energy** incentives: *https://bit.ly/VTDepartmentofForests-ParksandRecreation*.
- **Grants for working land:** *https://workinglands.vermont.gov/businessgrants*

Flood Recovery Rebates for Homeowners and Renters

To Homeowners and renters recovering from flood damage can get up to $24,500 back on eligible products, appliances, and weatherization services. See efficiencyvermont.com/floodrebate.

GMP Rebates Through 2023

Green Mountain Power (GMP) is extending its popular rebate programs through all of 2023 to help more customers save money while reducing carbon emissions.

Rebates include a $1,500 rebate on all electric vehicles, plus an extra $1,000 for low- and moderate-income customers, and a $400 base rebate on cold climate heat pumps with an extra $800 in incentives for income-eligible customers in partnership with Efficiency Vermont.

In 2022, the rebates and customized projects with business customers around the state will offset more than 173,000 metric tons of lifetime carbon emissions – the equivalent of taking 38,000 gas-fueled cars off the road.

Learn more about GMP's rebates on electric vehicles and charging at www.bit.ly/GMP-rebates-2, and heating and yard care at www.bit.ly/GMP-rebates-3.

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Department of Energy

Commercial Solar Rebate Program

Effective March 6, 2020, incentives are limited to 25% of the total project cost or $10,000 if less than the AC incentive payment otherwise calculated, whichever is less. The Program is available to non-residential structures with a commercial electric meter located in New Hampshire.

Incentive levels for PV systems are as follows:

- $0.20/watt (lower of AC and DC) for new solar electric facilities.
- Expansions to existing solar systems are not eligible.
- Incentive levels for solar thermal systems are as follows:
- $0.12/rated or modeled kBtu/yr for new solar thermal facilities fifteen collectors in size or fewer; $0.07/rated or modeled kBtu/yr for new solar thermal facilities greater than fifteen collectors in size;
- Expansions to existing solar systems not eligible.

Contact: https://bit.ly/NH-DOE_CommercialIndustrialSolar or at (603) 271-3670.

Residential Solar/Wind Rebate Program

Residential Solar/Wind Rebate Program closed

Residential Solar Water Heating Rebate Program is currently closed.

Commercial Bulk Fuel-Fed Wood C&I Pellet Central Heating Systems

- 40% of the heating appliance(s) and installation cost, up to a maximum of $65,000. An additional 30% up to a maximum $5,000 is available for thermal storage. Systems must be 2.5 million BTU or less. https://bit.ly/NH-DOE_CommercialIndustrialWoodPellet

Residential Wood Pellet Boiler/Furnace

- 40% of installed system up to $10k
- Must meet thermal efficiency and particulate emissions standards

Contact: https://bit.ly/NH-DOE_Residential-WoodPellet for more information and current program status.

LOCAL INCENTIVES

Many communities provide property tax exemptions for renewables. Check your town website for more information.

- *These are offered on a town-by-town basis.*
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes
- Information at www.energy.nh.gov/energy-information.
- **Plug-In Hybrid Electric Vehicles** (PHEV), and $300 on **Electric Motorcycles**.

NH Home Performance with ENERGY STAR

Sponsored by all NH electric and natural gas utilities in partnership by the U.S. Dept. of Energy. Fuel-blind eligibility using the Home Heating Index (BTUs of heating fuel / conditioned square feet / heating degree days). Must provide at least 12 months of heating fuel history. Once qualified, eligible homes get a $450 value comprehensive energy audit for $100 (rebated if improvements installed), and 75% instant rebate for eligible weatherization improvements up to a $8,000.

- Visit www.NHSaves.com/HPWES for more information and an online Home Heating Index calculator

NH ENERGY STAR Homes

- Incentives for new homes which meet ENERGY STAR guidelines. Incentives include
- HERS rating fees paid by the utility, rebates for ENERGY STAR lighting, appliances –up to $4,000 based on the HERS score.
- Visit www.NHSaves.com/newhome for more details.

NHSaves Residential ENERGY STAR ® certified Products Program

Mail-in/online rebates are available toward the purchase of the following ENERGY STAR® certified products: Clothes Washers, Clothes Dryers, Room Air Conditioners, Room Air Purifiers, Refrigerators, Dehumidifiers, and Pool Pumps. For current rebate information and forms go to www.NHSaves.com/nh-rebates.

- Refrigerator/freezer recycling is available – unit must be in working condition (10 – 30 cubic feet in size), program includes free pickup and $30 rebate. For program requirements and scheduling information go to www.NHSaves.com/recycle.
- Instant rebates available on select ENERGY STAR® certified LED light bulbs purchased through participating NH retailers(offers vary by retailer, see store associate for details) Visit: www.NHSaves.com/nh-rebates.
- Rebates are available to residential electric customers of the four NHSaves utilities.

NHSAVES Online Store

Our extensive online store offers discounted pricing for residential electric customers of the four NHSaves utilities on a large variety of LED light bulbs and fixtures, as well as offering additional products to make your home more efficient, such as lighting controls, advanced power strips, thermostats, water saving devices, and various weatherization products. Orders and product fulfillment are handled by our vendor, EFI.

- Visit www.NHSaves.com/lighting-catalog.

Plymouth Area Renewable Energy Initiative (PAREI): plymouthenergy.org

- **NH Solar Shares:** nhsolarshares.org

NHSaves: www.nhsaves.com

Energy Star® Residential Heating, Cooling, & Water Heating Equipment Rebate

Rebates of up to $500/ton on Air Source and Geothermal Heat Pumps. Rebates of $500 - $750 on Heat Pump Water Heaters. Rebates of $100 on WiFi Thermostats

- Program details and application at www.NHSaves.com/heating cooling

Other NH Electric Utility Programs

See also individual utilities for additional programs and variations. NH electric utilities may offer low or no interest on-bill financing for energy efficiency projects.

Visit www.NHSaves.com/resource/ for individual utility contact information.

New Hampshire Electric Cooperative (NHEC) offers a slate of additional programs hat are available for NHEC members only. They include:

Electric Vehicle & Charging Incentives:

- Up to $1,000 incentive on the purchase or lease of a qualified EV (Residential).
- Up to $300 incentive to install Level 2 or larger charging stations, w/ Off-Peak charging rate (Residential).
- Up to $2,500 incentive to install Level 2 or larger charging stations (Commercial & Municipal).

High Efficiency Heat Pump Incentives:

- $500 per ton, w/enhanced rebates up to additional $500 per ton; 2% financing available. (Residential & Commercial)

Business Programs

Includes programs for: small and large business, new equipment and construction, seminars, lighting incentives, and catalog, and low and no interest financing programs.

Visit www.NHSaves.com/ for information about NH business incentives for electricity efficiency.

NH Weatherization Assistance Income-Eligible Programs

Home Energy Assistance and NH community action Weatherization Assistance Program. Financial assistance paying fuel bills, and free weatherization improvements for qualified applicants. Funding from U.S. Dept. of Energy, NH utilities.

Visit www.bit.ly/GET-NH-4 for application criteria, FAQs and local program contacts.

Community Development Finance Authority (CDFA) Clean Energy Fund

Low-Interest Financing for Businesses, Non-Profits & Municipalities:

to support energy efficiency and renewable energy projects.

Small Business Energy Audit Grants
Rural Small Businesses & Agricultural Producers can apply for grants to cover 75% of a comprehensive energy audit cost.

Community Facilities Energy Assessment Grants

Non-Profits and Municipalities can apply to receive a grant covering 75% of the cost for an energy-related study.
Find out more at: www.nhcdfa.org/energy.

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED IN NEW YORK

There are 169 programs and incentives available at: https://www.dsireusa.org (enter your zip code).

Also visit https://www.nyserda.ny.gov/All-Programs/EmPower-New-York-Program for the latest NYSERDA solar, ground source and air source heat pumps, EV, residential, and commercial incentives.

Select New York State utilities offer incentives for heat pump systems.

Please check with your local utility for more information or to learn more about heat pumps, available rebates, and financing options on the NYS Clean Heat program website at https://cleanheat.ny.gov/.

National Grid: To get the latest info go to: NGRID.com/Save.

Clean Energy Incentives and Tax Credits for Renewable Energy

- SOLAR: Incentives to install renewables: https://www.nyserda.ny.gov/ny/PutEnergyToWork/Energy-Program-and-Incentives/Renewable-Technology-Programs-and-Incentives
- **ADVANCED WOOD HEAT:** A 22% investment federal tax credit applies to the installed cost of home heating and hot water systems that utilize wood pellets, chips and cordwood at efficiencies greater than 75 percent high heat value.
- **GEOTHERMAL HEAT PUMPS:** The 26% federal tax credit was also extended for geothermal heat pump projects that begin construction in 2022. NY homeowners are eligible for a 25% State tax credit up and additional incentives could be available from their utility provider.
- **AIR SOURCE HEAT PUMPS:** Most utilities also offering incentives on both central air source heat pump systems as well as mini-splits.

Electric Vehicle Charging Station Make-Ready Program

- National Grid and other utilities will do an analysis of your business or municipality to evaluate installing EV stations and accessing the type of EV needed for your fleet. Learn more information from their website: (https://bit.ly/NG-EV-MakeReadyProgram.

Check out your local utility's website for was to save more on your energy-efficient projects:

- **National Grid:** https://ngrid.com/3H7hBPU
- **National Grid High Priority Electrification:** https://bit.ly/CleanHeatNY_HeatPumpIncentives
- **Central Hudson**: https://bit.ly/CENHUD_SaveEnergy
- **NYSEG**: https://bit.ly/NYSEG_SaveEnergy
- **PSEG Long Island:** https://bit.ly/PSEGLI_SaveEnergy
- **RG&E:** https://bit.ly/RGE_SaveEnergy

ReWire America Calculator.
https://www.rewiringamerica.org/app/ira-calculator

Read up on electrification at:
https://homes.rewiringamerica.org/

MAINE

EFFICIENCY MAINE

All incentives and rebates are subject to change without notice. For information on Efficiency Maine's programs go to efficiencymaine.com or call 866.376.2463

Home Insulation:

Efficiency Maine offers insulation rebates of 80% up to $8,000 for income-eligible homeowners and 40% up to $4,000 to Mainers of all incomes. .

See bit.ly/EffME_HomeInsulation. Residents can estimate home energy efficiency with the calculator at bit.ly/EffME_SavingsCalculator.

To find a vendor go here: https://www.efficiencymaine.com/at-home/vendor-locator/.

Multifamily Insulation:

Efficiency Maine also offers incentives for multifamily insulation and air sealing. Multifamily buildings with five or more units may be eligible for attic and basement insulation with air sealing incentives of 50% of the project cost, up to $5,000.
For more information go to https://www.efficiencymaine.com/at-work/insulation-solutions/

Heat and Cooling:

Rebates and financing for the installation of high-efficiency equipment. To find out more about heating solutions, for your home go to: https://www.efficiencymaine.com/heating-solutions/. For business heating and cooling solutions go to: https://www.efficiencymaine.com/at-work/heating-and-cooling-solutions/. Homeowners can estimate their annual heating costs for different heating systems using the Compare Home Heating Costs Calculator here: https://www.efficiencymaine.com/at-home/heating-cost-comparison/. To find a vendor go here: https://bit.ly/EffME_VendorLocator. To find a qualified partner for business solutions, go here: https://bit.ly/EffME_BusinessSolutionsPartner.

Heat Pumps:

Efficiency Maine offers heat pump rebates of 80% up to $8,000 for income-eligible homeowners and 40% up to $4,000 to Mainers of all incomes.

Businesses, municipalities, schools, and other non-residential facilities are eligible for commercial incentives. Learn more at the Efficiency Maine heat pump website hub at efficiencymaine.com/about-heat-pumps/.

Heat Pump Water Heaters: Efficiency Maine offers mail-in rebates and instant discounts up to $950 on heat pump water heaters. Low-income Mainers can qualify for an installed unit at no cost. Learn more at www.bit.ly/EffME_WaterHeatingSolutions. Compare Water Heater Cost Calculator to estimate savings is at bit.ly/EffME_WaterHeatingCostComparison.

Electric Vehicles (EVs): Efficiency Maine offers instant discounts for eligible battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) at participating Maine car dealerships. Low- and moderate-income Mainers, businesses, and governmental entities can qualify for enhanced EV rebates. Learn more at efficiencymaine.com/electric-vehicle-rebates/.

Electric Vehicle Charging Solutions: Charging in a single-family home is convenient and inexpensive. For those reasons, most EV drivers charge at home using either a Level 1 charger or a fasterLevel 2 charger. For public sites like businesses, municipalities, or multi-family residential complexes can increase employee satisfaction, demonstrate sustainability commitments, strengthen relationships with customers, and attract new ones. Efficiency Maine offers information and tips for consumers and businesses looking to install EV chargers. Learn more at: https://www.efficiencymaine.com/at-work/electric-vehicle-charging/

Commercial: Efficiency Maine has programs for businesses of all sizes, including multifamily buildings with three or more units or more and Maine's largest energy customers, businesses, for profit or non-profit; municipalities; schools and higher ed facilities; industrial facilities; non-residential facilities; mixed-use buildings, and multifamily buildings with three or more units. To learn more about incentives for energy efficiency solutions, how to get started, and program details, visit https://www.efficiencymaine.com/at-work/. To find a contractor participating in Efficiency Maine programs as a Qualified Partner: https://bit.ly/EffME_BusinessSolutionsPartner.

Appliances: $50 rebates available for ENERGY STAR® certified clothes washers: bit.ly/EffME_ClothesWasher_Rebate

The empower program is a good place to start by making your home or apartment energy efficient, more comfortable and healthy

Commercial Buildings EPA 179D

Take up to $1.88/ sqft if qualified) Visit https://www.energytaxsavers.com/ for more details.
https://www.energy.gov/eere/buildings/179d-commercial-buildings-energy-efficiency-tax-deduction

UP-TO-DATE INCENTIVE INFORMATION CAN BE FOUND AT: WWW.DSIREUSA.ORG

Climate Change Behind Sharp Drop in Snowpack Since 1980s

Dartmouth study finds steepest drops in areas of the Northern Hemisphere reliant on snow for water.

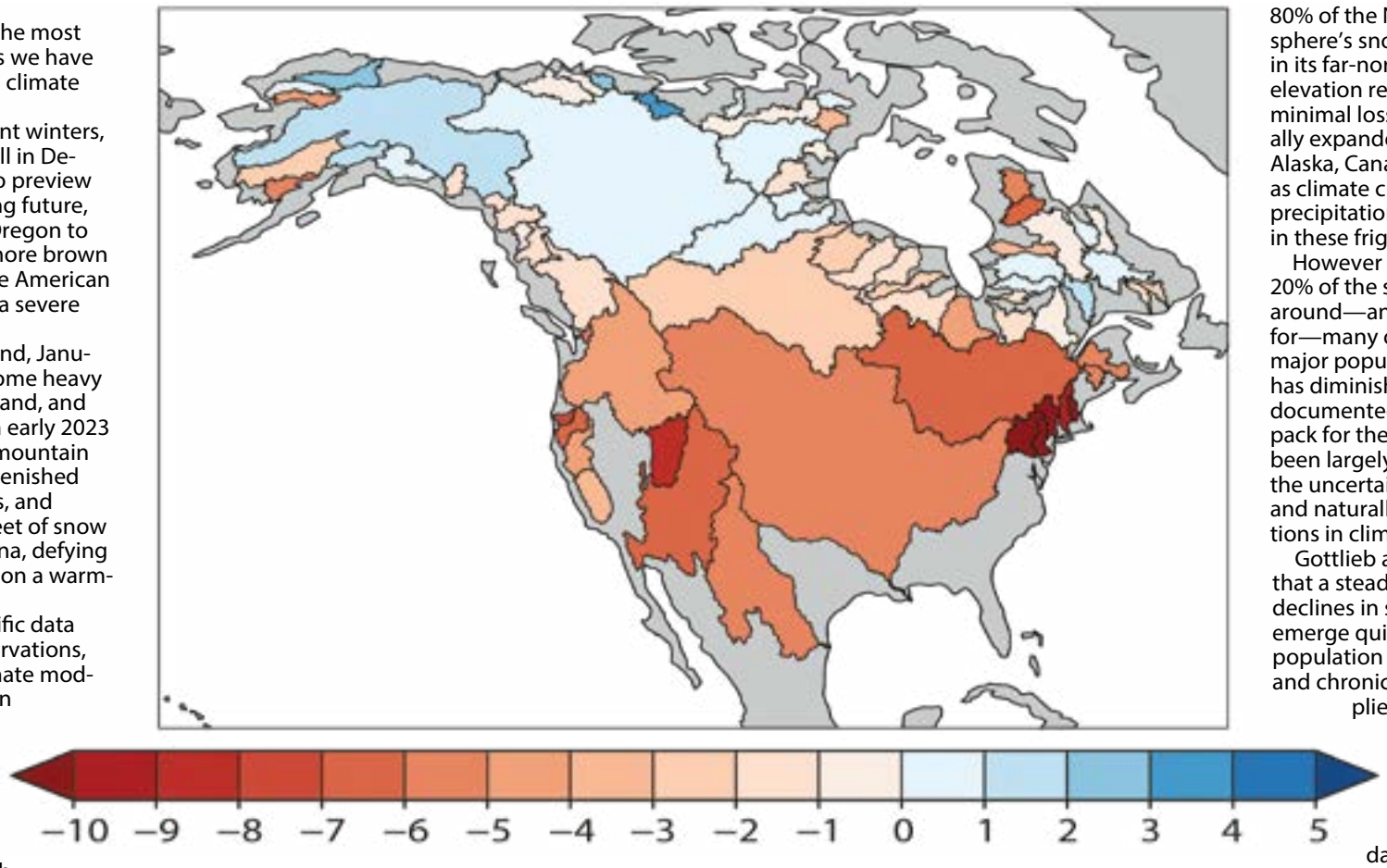
Morgan Kelly

Snow is one of the most contradictory cues we have for understanding climate change.

As in many recent winters, the lack of snowfall in December seemed to preview our global warming future, with peaks from Oregon to New Hampshire more brown than white and the American Southwest facing a severe snow drought.

On the other hand, January has brought some heavy snow to New England, and record blizzards in early 2023 buried California mountain communities, replenished parched reservoirs, and dropped eleven feet of snow on northern Arizona, defying our notions of life on a warming planet.

Similarly, scientific data from ground observations, satellites, and climate models do not agree on whether global warming is consistently chipping away at the snowpacks that accumulate in high-elevation mountains and provide water when they melt in spring, complicating efforts to manage the water scarcity that would result for many population centers.



The Southwest and Northeast saw the greatest loss in spring snowpack between 1981 and 2020, raising concerns about water scarcity, and economies reliant on winter recreation. The numbers at bottom correspond to the percentage of spring snowpack lost (red) or gained (blue) per decade, with losses concentrated in populated regions. (Image by Justin Mankin and Alexander Gottlieb)

Now, *a new Dartmouth study* cuts through the uncertainty in these varying observations, and provides evidence that seasonal snowpacks throughout most of the Northern Hemisphere have indeed shrunk significantly over the past 40 years due to human-driven climate change. The sharpest global warming-related reductions in snowpack—between 10% to 20% per decade—are in the Southwestern and Northeastern United States, as well as in Central and Eastern Europe.

Researchers *Alexander Gottlieb* and *Justin Mankin* report in the journal *Nature* that the extent and speed of this loss potentially put the hundreds of millions of people in North America, Europe, and Asia who depend on snow for their water on the precipice of a crisis that continued warming will amplify.

"We were most concerned with how warming is affecting the amount of water stored in snow. The loss of that reservoir is the most immediate and potent risk that climate change poses to society in terms of diminishing snowfall and accumulation," says Gottlieb, the study's first author and a *Guarini School of Graduate and Advanced Studies* PhD candidate in Mankin's research group and the *Ecology, Evolution, Environment and Society* graduate program.

"Our work identifies the watersheds that have experienced historical snow loss and those that will be most vulnerable to rapid snowpack declines with further warming," Gottlieb says. "The train has left the station for regions such as the Southwestern and Northeastern United States. By the end of the 21st century, we expect these places to be close to snow-free by the end of March. We're on that path and not particularly well adapted when it comes to water scarcity."

Water security is only one dimension of snow loss, says Mankin, an associate professor of *geography* and the paper's senior author.

The Hudson, Susquehanna, Delaware, Connecticut, and Merrimack watersheds in the Northeastern U.S., where water scarcity is not as dire, experienced among the steepest declines in snowpack. But these heavy losses threaten economies in states such as Vermont, New York, and New Hampshire that depend on winter recreation, according to Mankin; even machine-made snow has a temperature threshold many areas are fast approaching.

"The recreational implications are emblematic of the ways in which global warming disproportionately affects the most vulnerable communities," he said. "Ski resorts at lower elevations and latitudes have already been contending with year-on-year snow loss. This will just accelerate, making the business model inviable."

"We'll likely see further consolidation of skiing into large, well-resourced resorts at the expense of small and medium-sized ski areas that have such crucial local economic and cultural values. It will be a loss that will ripple through communities," Mankin said.

In the study, Gottlieb and Mankin focused on how global warming's influence on temperature and precipitation drove changes in snowpack in 169 river basins across the Northern Hemisphere from 1981 through 2020. The loss of snowpacks potentially means less meltwater in spring for rivers, streams, and soils downstream when ecosystems and people demand water.

Gottlieb and Mankin programmed a machine-learning model to examine thousands of observations and climate-model experiments that captured snowpack, temperature, precipitation, and runoff data for Northern Hemisphere watersheds.

This not only let them identify where snowpack losses occurred due to warming, it also gave them the ability to examine the counteracting influence of climate-driven changes in temperature and precipitation, which decrease and increase snowpack thickness, respectively.

The researchers identified the uncertainties that the models and observations shared so they could home in on what scientists had previously missed when gauging the effect of climate change on snow. A *2021 study by Gottlieb and Mankin* similarly leveraged uncertainties in how scientists measure snow depth and define snow drought to improve predictions of water availability.

Snow comes with uncertainties that have masked the effects of global warming, Mankin said. "People assume that snow is easy to measure, that it simply declines with warming, and that its loss implies the same impacts everywhere. None of these are the case," he said.

"Snow observations are tricky at the regional scales most relevant for assessing water security," Mankin said. "Snow is very sensitive to within-winter variations in temperature and precipitation, and the risks from snow loss are not the same in New England as in the Southwest, or for a village in the Alps as in high-mountain Asia."

Gottlieb and Mankin in fact found that 80% of the Northern Hemisphere's snowpacks—which are in its far-northern and high-elevation reaches—experienced minimal losses. Snowpacks actually expanded in vast swaths of Alaska, Canada, and Central Asia as climate change increased the precipitation that falls as snow in these frigid regions.

However it is the remaining 20% of the snowpack that exists around—and provides water for—many of the hemisphere's major population centers that has diminished. Since 1981, documented declines in snowpack for these regions have been largely inconsistent due to the uncertainty in observations and naturally occurring variations in climate.

Gottlieb and Mankin found that a steady pattern of annual declines in snow accumulation emerge quickly—and leave population centers suddenly and chronically short on supplies of water from snowmelt.

Many snow-dependent watersheds now find themselves dangerously near a temperature threshold Gottlieb and Mankin call a "snow-loss cliff." This means that as average winter temperatures in a watershed increase beyond 17 degrees Fahrenheit (minus eight degrees Celsius), snow loss accelerates even with only modest increases in local average temperatures.

Many highly populated watersheds that rely on snow for water supply are going to see accelerating losses over the next few decades, Mankin said.

"It means that water managers who rely on snowmelt can't wait for all the observations to agree on snow loss before they prepare for permanent changes to water supplies. By then, it's too late," he said. "Once a basin has fallen off that cliff, it's no longer about managing a short-term emergency until the next big snow. Instead, they will be adapting to permanent changes to water availability."

Morgan Kelly is the Senior Media Relations Officer for Dartmouth College.

Reprinted with permission from Dartmouth's blog on January 10, 2024, https://bit.ly/Dartmouth_SnowpackStudy. ♻

Justin Mankin, associate professor of geography, left, and Guarini PhD candidate Alexander Gottlieb. (Photo by Eli Burakian '00/Dartmouth)

Agriculture's Answer to Eliminating Fossil Fuels is Right Under Our Feet!

Joanne Coons

Sometimes proven technology is the solution to doing things a little differently and a little better. Applying ground-source heat pump (GSHP) technology to heating and cooling long tunnel greenhouses provides a low-cost solution to maintain the required temperature needed to keep plants thriving all year long.

One such example of using GSHP technology is the Moonshot Farm (which grows cut flowers) in East Windsor, New Jersey. Moonshot wanted to expand to a second 3000 square feet of growing space using a standard Quonset hut-type double-layer poly sheet construction with an air gap rated at R1.8. There are eight-foot-wide sliding doors on both ends that are very modestly sealed. There is no additional insulation; flowers are grown directly in the floor soil. In the existing "propane twin" long tunnel greenhouse, keeping the temperature to a nominal 50°F during 2021-2022 used approximately $6,800 of propane. This is not sustainable! There has to be a better way.

The owners became aware of the USDA Rural Energy for America Program (REAP) grant that could defray 25% of the cost of qualifying renewable energy systems. Moonshot Farm reached out to James Thomas of Thomas Geothermal Engineering (TGE) to assess if a geothermal heating and cooling system was feasible, could substantially reduce its energy bill, and be a strong enough case to be awarded the REAP grant. The owners also thought a green energy system would be a strong selling point to its customer base. A simple calculation quickly revealed that a geothermal system could indeed be within reach for this application and provide the annual heating load. Moonshot was awarded a grant on July 7, 2022 at which time TGE commenced a detailed design and ordering of materials.

The temperature range for the cut flowers is between 55-70°F. The winter design temperature for the GSHP at this location is 15°F. This would require a 10.86-ton design load, so two WaterFunace Series 5, two-speed six-ton geothermal units would be needed. (The six-ton unit uses two phase wire which the farm is wired for, not a three- phase commercial wiring.) The water pump is a Geo-Flo NP Multi flow center with a Grundfos Magna3 variable speed pump. There is a 1.5-acre open pasture next to the greenhouse that was chosen for a horizontal loop. The loop included seven six-foot-deep, 300-foot-long trenches using Twister pipe by Agreenability which increases pipe surface area and increases heat transfer which shortens the length of pipe needed. (Less drilling or digging, less pipe needed). The two units were arranged on each end of the tunnel to help balance the temperature. DuctSox lightweight fabric duct was chosen to distribute the forced air evenly down each trunk. Since this was expected to be an unbalanced heating dominant application, the system will capture heat and recharge the ground particularly during summer months. The system can also be used as low-cost compressor-less cooling as needed. Some A/C was used even on freezing winter days when the tunnel would otherwise warm up to 90°F; winter crops need 70°F or less. In accordance to the USDA grant the installed system must be monitored for three years after installation to prove its efficiency.

Moonshot Farm has two 3000 square foot greenhouses where flowers are grown directly in the floor soil. A geothermal system was installed to maintain the proper temperature to grow the flowers. (Courtesy photos)

Financials: The USDA grant has been expanded from the 25% in 2022 to 40% as of 2023. The Inflation Reduction Act will provide a 30% incentive, and if there is domestic content, the rebate will increase to 40%. The one-year electricity use for the GSHP hoop house is $2080. The installation cost was $94,673. The cost of propane to heat the tunnel is $6774 (remember there is a propane twin to measure and compare the GSHP hoop house). At the 2024 incentive rate, reducing the initial cost by 80% (USDA 40% and IRA 40%) the installation cost adjusts to $18,953. If you divide that by the cost savings of propane which is $4,694, that gives a return on investment of 4.03 years. As a business, the remaining investment after funding can be depreciated over five years, so this model is a no-brainer, as they say. It is worth mentioning pricing, grant application and processing and payment to the installer needs to be coordinated and may require large upfront costs before payback or additional loans to bridge the payback period. If you were to add a solar photovoltaic system to power the farm's electricity, that system would qualify for the same financial incentives.

Some of the other benefits of this system are the ability to grow fruits, vegetables and plants year-round locally thus further reducing the farm's carbon footprint. Produce could be fresher; crops won't be as weather-dependent i.e., reducing crops damaged by frost, floods or heat waves.

Does this sound like an award-winning design? If you said yes, you would be correct! James Thomas won the 2023 IGSHPA (International Ground Source Heat Pump Association) Commercial Innovation Award and is the finalist for NY-GEO Top Job Award.

If you know a farmer or organized community gardens, please share this information with them.

Joanne Coons teaches at Hudson Valley Community College, TEC-SMART facility teaching. Locally, Joanne advocates for sustainability as a member of the Town of Clifton Park's GREEN (Government Re-Thinking Energy & Environment Now) and is active in NY-GEO and NYSES. Prior to her current endeavors, she taught high school science for 28 years. ♻

A New Guide for Residential Composting in Vermont

Michael J. Daley

"The Dirt on Compost" is a new guidebook from the Vermont Department of Environmental Conservation (DEC) intended to provide residents with the information they need to comply with Vermont's Universal Recycling Law, Act 148, passed unanimously in 2012. The law banned all food scraps from the landfill starting July 1, 2020. This mandate refers to all Vermonters—businesses, grocery stores, schools, offices, cities, events, and residents.

Other than the risk of running afoul of the compost police (just kidding, for now anyway), why might you want to comply with the ban on throwing food into the trash?

Almost 20 percent of all Vermonters' landfilled waste is food scraps. In the airless conditions of a landfill, these scraps release methane. According to various sources methane is anywhere from 34 to 86 times more powerful as a greenhouse gas than is carbon dioxide. Properly composted food waste doesn't produce methane.

The new guide was adapted with permission from the Central Vermont Solid Waste Management District's "The Dirt on Composting" written by Julie Berbiglia, Composting and Master Gardener, Scarritt-Bennet, with Sharon Smith, Recycling Coordinator and Master Composter, Metro Public Works, Division of Waste Management, Nashville, Tennessee. The DEC's edition was rewritten and edited by Cassandra Hemenway, Central Vermont Solid Waste Management District and Vermont Master Composter. It was designed by Dana Dwinell-Yardley.

Written in a straightforward, jaunty style that avoids, shall we say, getting lost in the weeds of techno-jargon, the guide provides the basic information and techniques to help the ordinary person get started (or improve) composting in their backyard. It also addresses many of the common concerns such as: Do I have enough space? Will it smell? Will it bring animals? It's attracting flies! Why is my pile too dry or too wet?The guide provides practical solutions to them all.

The booklet's primary focus is to encourage composting.However, the authors do point out that there are other options to keep food scraps out of the trash if a resident doesn't have the space, or can't do composting for any other reason. All Vermont's transfer stations, bag drops, and fast trashes accept food scraps, often for a fee. In some parts of Vermont, food scrap haulers will pick up from residences for a fee. Food scraps can be dropped off at many commercial compost companies. Join (or start) a neighborhood community composting site and learn to make compost together to apply on a community garden. Share your pile with a less fortunate neighbor or seek someone near you who will let you bring your food scraps to enrich their pile.

But if you're ready to roll up your sleeves and make compost, this guide definitely delivers on its promise to help you do that successfully. It begins by asking you to keep in mind four fundamental questions as you read. *Cont'd on p.37*

Fossil Fuels Give Way to Warm Rock at College Campuses

Michael J. Daley

When I was assigned the task of investigating the many college and institutional geothermal heating systems being installed or planned for the northeast, I had visions of well drillers probing the Earth for hidden bubbling, boiling reservoirs of water.

"Not so," Bart Cushing of Keene, New Hampshire-based Cushing and Sons informed me, "It's pretty much fifty degrees down there."

The test wells his company and others drill are to determine the rock's capacity to supply the amount of heat needed by the structures on the surface. The less often used term "geoexchange" is far more evocative of what is actually going on: a watery dialog with the reliability of the 50-degree thermal gradient about 500-800 feet beneath Earth's surface.

"What happens is we take that fifty degrees and extract twenty, then return the colder water to get reheated," Bart explained. "It's perpetual and a good deal."

His company did a full geoexchange system for the Cheshire County Jail consisting of eighty 400-foot wells that paid back the investment in just five years due to the increase in natural gas prices.

"The system is good for a hundred years and completely invisible, everything is five feet underground." Bart also notes that since the water loop is completely isolated, these systems can even be installed in brownfields and contaminated water sites.

Above: Tufts University geothermal system installed in January 2019. Rt: Heat testing (generator and heat unit with white blanket covering) is done after the tubing and grout is installed. The test is run for 48 hours sending heat into the ground and measuring how much heat the formation will generate. In the northeast region, 160 to 190' of borehole per 12,000 Btu/hr. is the amount a borehole will sustain using a conventional ground source heat pump. (Cushing and Sons)

Geoexchange heating systems are exploiting that amazing aspect of thermodynamics where any heat differential can be used to produce work with the right understanding and technology. In this case, heat pumps are used.

Founded in 1972 by his father, Bart and Jeff Cushing worked at well drilling in high school and joined the company full time in 1979. In the years since, Cushing and Sons has grown steadily from a one-rig business to their present fleet of three modern high-capacity pneumatic hammer drill rigs. They have installed over 35,000 wells and systems.

Those rigs have been in high demand recently to drill test wells at many regional colleges which hope to exploit the geothermal capacity beneath their campuses to replace their fossil fuel fired heating systems. Each hole can take up to two-and-a-half days to complete. Cushing explained, "Once the test well is dug 500-800 feet, we drop down dr11 pipe forming a U tube. Then we conduct 48 hours of flow and heat measurements. For example, typical results indicate 160 to 180 feet per ton of energy capacity with a recirculation rate of three gallons per minute per ton. For reference a ton of energy is 12,000 Btu/hr."

From there it's simply a matter of engineering to determine the linear vertical footage required and number of production wells that are needed to meet the heating needs of the buildings. That number could be anywhere from a few dozen for a residential system to the more than 2,000 holes that are projected for the Princeton University geoexchange project.

"We just lost a bid to do 130 holes on the Green at Dartmouth," Cushing chuckled. "We did the original test holes there in 2019. You do not win them all."

When I noted that he did not sound too disappointed, Cushing explained, "There's so much demand these days I'm running into hard choices about how to deploy equipment. We have only so many drilling rigs and skilled personnel in the region."

Cushing does not want to shortchange his water well drilling operations because that is where the bread and butter come from. He said, "These geo systems are a one off from the business perspective. They last a hundred years and nothing else is needed. Not so our relationship with our other customers. That's ongoing and I value the connection."

"The colleges all have a pact for the climate and they see these systems as the answer," Cushing said. He quickly ticked off an impressive list of regional institutions currently developing geoexchange heating solutions, including Dartmouth College, UMass at Amherst, Smith College, University of Vermont, Norwich University, and Greenfield Community College.

We are talking about significant change here and really good news for the planet. For instance, Dartmouth College burns 3.5 million gallons of No. 6 fuel oil (the dirtiest kind) in its steam heating plant. The climate action plan introduced by then-president Phil Hanlon in 2017 called for a switch from oil to renewable heat by 2025. The College already heats two buildings with geothermal and in 2022 began investigating four more sites on campus with the hope that this source of clean energy can completely replace the steam plant.

Similarly, Smith College in Northampton, MA uses fossil fuels for heat. Also, in 2022 they committed to replacing their heating plant with a geoexchange system. They have already identified sufficient geothermal resources and begun actual drilling for production fields. The project is proceeding in three phases scheduled for completion in 2028. When the switch is complete, the campus will produce 90% less carbon emissions.

One of the most heartwarming aspects of this surge of interest in geothermal energy is illustrated by an anecdote Cushing rela; ted to me with his worldly-wise chuckle.

"We were in the middle of the UMass campus drilling some test holes and people going by were flipping us the bird because they thought we were doing some new construction. So, we put up some signs explaining we were working on green energy and right away those fingers turned to high fives."

A recent New York Times article on this subject noted that geoexchange systems at colleges around the country seem to be earning a rare commodity on campuses these days: the approval of students, faculty, staff and alumni. The article quotes David DeSwert, executive vice-president for finance and administration at Smith College who said "I've never seen this level of consensus behind a project."

Hearing of this, it dawned on this seasoned fighter from the age when renewable energy was considered a mere pipe dream that a whole new generation of young people are coming of age, not with a promise of a better way but actually seeing that better way materializing before their eyes.

Cushing and Sons has worked at the colleges of UMass, Amherst, Smith, Dartmouth, Williams, Marlborough, and Keene State. They also installed geoexchange systems at the schools of Kimball Union Academy, Eaglebrook, Kingswood, and Oyster River.

Michael J. Daley taught renewable energy on the Great New England Energy Show Van of the New England Coalition for 20 years, featuring the first ever solar-powered ice cream freezer funded by Ben and Jerry's. ♻

New Innovative Geothermal Manufacturing Facility Coming to Troy, NY

Energy Catalyst, LLC (Capital Region) Among 19 Projects Awarded More Than $15 Million for Regional Economic Development

On February 5, Governor Kathy Hochul announced that over $15 million has been awarded to support 19 projects across New York State through the Regional Economic Development Council initiative. Round XIII included core capital grant and tax-credit funding from Empire State Development, which was made available on a continuous and competitive basis to support the immediate needs of communities. Funding will support impactful projects that align with each region's strategic goals.

Energy Catalyst's heat pump system is the only ground source Energy Star-certified heat pump in North America that can reuse existing home baseboards and radiators. (Courtesy photo)

"With these investments in fast-growing sectors like broadband manufacturing and heat pump technology, the Regional Economic Development Council Initiative is continuing to unlock the economic potential of our state," Governor Hochul said. "These businesses are driving innovation and creating good, stable jobs for New Yorkers, and thanks to our REDCs and significant state support, we are writing them into New York's economic success story."

This second round of projects was recommended by each Regional Council because of their project readiness and alignment with each region's strategic plan. Highlights include:

- Energy Catalyst, LLC (Capital Region) – $850,000 ESD Grant, $1.135 Million Excelsior Jobs Tax Credit:
- Energy Catalyst, LLC (EC) is a growing heat pump manufacturer and technology company the produces the only ground source Energy Star-certified heat pump in North America that can reuse existing home baseboards and radiators.
- EC will construct a new manufacturing facility including assembly line, testing lab, training area, and office spaces in North Troy.

A list of other recipients can be found at *https://on.ny.gov/3HMvcy2*.

The REDC process continues to support and empower regional stakeholders in developing strategic plans and funding priorities that meet local economic needs. To date, more than $8 billion has been awarded to more than 9,900 job creation and community development projects through the REDC Initiative consistent with each region's strategic plan. ♻

NY Geothermal Conference

April 8-9, 2024

Christine Hoffer

The New York Geothermal Energy Organization, NY-GEO, will host its Albany conference on April 8-9 at the Marriott on Wolfe Road. The conference will bring together the best of the best in the geothermal industry offering inspirational keynotes and educational tracks that will appeal to seasoned professionals, as well as someone new to the industry.

Three different education tracks are offered including Design, Policy and Programs, and Building Electrification. These tracks will highlight sessions including GEO 101, Catching up on IRA Implementation, Geothermal Drilling Regulations, Utility Thermal Energy Networks (UTEN), Workforce Development, and much more.

Attendees will include geothermal designers and contractors, utilities, drillers, state agencies, organized labor, universities, and manufacturers from around the world. In 2023, the conference welcomed over 650 attendees from 23 states and four countries. Over 45 exhibitors will be showcasing a wide range of products and services needed to advance geothermal, ground source heat pumps (GSHP).

NY-GEO is a not-for-profit trade association, founded in 2014 and representing the geothermal heat pump (GHP) industry in New York State dedicated to promoting geothermal heating and cooling. NY-GEO's mission is to grow the geothermal heat pump industry and develop its workforce while educating policymakers and residents about the benefits of geothermal heat pumps. It is the driving force in the mass adoption of ground-source (geothermal) heat pumps for residential, commercial, and utility-scale heating and cooling in New York State while working and supporting neighboring states and communities.

NY-GEO will host its first conference in downstate NY on October 21 through 23, 2024 at the Brooklyn Bridge Marriot. The event will emphasize content on how to address densely populated areas and large commercial buildings.

To learn more about NY-GEO and the conferences, visit www.ny-geo.org.

Christine Hoffer is the NY-Geothermal Executive Director. ♻

A Networking Geothermal System

An artist's drawing for an explanation of how a geothermal net-working system operates. See library blog post "Gas to Geo" at www.heet.org. (Courtesy of Carrie Klein and HEET)

Green Heating Fuels from Bourne's Energy

Jessie Haas

In drafting laws and regulations to promote clean-energy technologies, states and the federal government have hoped to ensure that these options are available to those in lower-income brackets. However, when a retrofit or replacement of your entire heating system is needed in order to go "clean and green," a lot of people just can't afford the investment.

There are options, though, as simple as just changing what you burn in your existing furnace, heater, or backup generator. For well over a decade, Morrisville, Vermont energy company Bourne's Energy has been offering green heating fuels to communities in central and northern Vermont and wood pellets throughout the entire state. They offer liquid fuel called BioHeat or BioDiesel as an alternative to conventional oil. This biofuel is made from cooking oils collected from around New England, which are cleaned and processed to produce a carbon-neutral fuel. Biofuel can be directly substituted for conventional petroleum-based heating oil or diesel.

Biofuel is typically used in a blend with conventional diesel, categorized by the percentage of bio in the blend. B20 BioDiesel for instance, is 20% biofuel and 80% petroleum. Bourne's Energy sells several blends, including B99, which it states is "really more like B99.99" and is the highest blend available on the general market. In most cases, all the blends can be used in existing furnaces without equipment modifications. For B99, a site visit is required up front, but that visit is at no cost to the customer. All Bourne's biofuel is blended at the company's blending plant in Morrisville, VT which was built in 2012 to give the company greater control over the process and range of blends of biofuel it could offer customers. Biodiesel for vehicles is available at three pump stations in Vermont, Morrisville, Lyndonville, and Hardwick.

Bourne's Energy biofuel truck fueling up.

Bourne's Energy biofuel blending plant and rewnewable propane in Morrisville, VT (Courtesy photos)

Bourne's Energy has not sold straight conventional heating oil for over a decade, and all its oil customers receive biofuel, so any oil customer can immediately lower their carbon footprint simply by switching their fuel provider to Bourne's Energy. According to spokesperson April Merrill, Bourne's is "the only energy company in Vermont that offers all of the following low carbon products: Biofuel/B99, biodiesel for vehicles, renewable propane, wood pellets, heat pumps, and other energy-efficient equipment (i.e., furnaces, boilers, bulk wood pellet storage). Everything we offer is with the goal of doing the right thing and helping people reduce their carbon footprint in a manageable way." Their most recent addition to their green fuel lineup is renewable propane. Bourne's was the first energy provider to bring renewable propane to Vermont for home heating use with its first delivery on September 19, 2023.

Bourne's Energy has long been a propane dealer, and to be clear, propane is already considered a clean-energy fuel, approved in the 1990 Clean Air Act. Propane occurs naturally in oil and gas wells, is not itself a greenhouse gas (GHG), and can emit up to 38% fewer GHGs than the fuel oil burned in most furnaces (as well as half the CO2 of charcoal barbecues.) It contains virtually no sulfur, and emits no soot, nitrogen oxide, or methane.

Now propane gets even better, with the introduction of renewable propane. Also known as bio-propane or green propane, it is produced (along with biodiesel) from biomass feedstocks such as plant oils, animal fats, and other food and agricultural wastes, similar to biodiesel. Where renewable propane scores highest is in its carbon intensity value, which is four times lower than conventional propane and five times lower than diesel. According to Bourne's, "At the point of combustion, renewable propane is carbon-neutral, meaning no new carbon is added to the atmosphere when renewable propane is burned." While it does release CO2 into the atmosphere when burned, "the CO2 emissions are offset by the carbon dioxide absorbed by the plants that were used to produce the renewable feedstocks, making it a closed carbon cycle." The environmental benefit, of course, depends on the feedstock, but assuming that food waste is used, it should be substantial. Bourne's states that renewable propane can be used in existing propane heating systems, "making it a convenient option for homeowners looking to reduce their carbon footprint and make a difference, without a costly investment." As with its biofuel option, renewable propane will be blended with traditional propane so any customer who uses Bourne's Energy for their propane delivery will be making a difference and reducing their carbon footprint.

Whether you fuel your home or business with oil, propane, or wood, Bourne's Energy has an option to help you lower your carbon footprint, without a costly investment. This concerted effort to bring affordable green options the community, combined with their extensive history of giving back to Vermonters, were strong contributing factors that led to Bourne's Energy being named Outstanding Business of the Year for 2023 by the Vermont Chamber of Commerce and Vermont Business Magazine. Co-Owner Mike Bourne said, "This award is really a reflection on the quality of the people we have. How we work together for our customers is part of what sets us apart. We feel it is our duty as a leader in the fuel industry to forge the path for Vermonters to reduce their carbon footprint with environmentally friendlier heating fuels and high-efficiency equipment that are affordable and easy to implement. I speak for the entire Bourne's Energy work family in thanking the Vermont Chamber and Vermont Business Magazine for this award."

Bourne's Energy installing a heat pump for a customer in northern Vermont

For homeowners able to make the investment, Bourne's Energy sells a full line of equipment to help you lower your carbon footprint, and there are rebates and incentives available as well. For those of us who aren't ready to make that kind of investment, it's nice to know there are fuel options we can choose right now, to help us make a difference.

Jessie Haas lives in a 450 square-foot off-grid cabin in southeast Vermont with husband Michael J. Daley. She is the author of 41 books, including Snow Day. ♻

Energy Secretary Granholm Focus on Cold Climate Heat Pumps in NH

George Harvey

Janet Granholm, the U.S. Secretary of Energy, recently made her way to New Hampshire to talk with people about new cold-climate heat pumps. Her goal was to promote a switch away from fossil fuels and to heat pumps.

Some people might not think they are familiar with heat pumps, but almost everyone with electricity has one. Refrigerators and air conditioners work because of heat pumps built into them. Just as a water pump pushes water from a lower place to a higher one, a heat pump moves heat from a cool place to a hotter one. A refrigerator's cooling system extracts heat from the cold inside a unit and releases it into the warmer kitchen. A household heat pump does the same thing, moving heat from cold outside air into a warm house, though in hot weather, it can function to move heat from a cool house interior to the hot outside air.

Janet Granholm. (Alyson Fligg, Labor Department)

Heat pumps for households have been around for a long time, but in the old days, they were not all that good at heating when the outside air got very cold. Some of them were really only good when the outside temperature was above freezing.

Now, however, new cold weather heat pumps can heat when outside air is below 0°F (about -18°C). *Green Energy Times'* first notice of the new heat pump type was a notice of a Cold Climate Heat Pump Workshop, in April 2015. Since that time their use has grown, but the growth may have been too slow for Secretary Granholm.

There are a number of reasons for people to switch to heat pumps. They are often the least expensive heat for a home, and they

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Efficiency and Savings for Your Home
Geothermal Heat Pump Solutions from ClimateMaster®
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Efficiency Vermont's Efficiency Excellence Network (EEN)

Contractor Spotlight: Sisler Builders Energy Division

Interview with Mike D'Muhala, Energy Division Manager, Stowe, Vermont

G.E.T. Staff

G.E.T.: How and when did you get started in this industry?

Mike D'Muhala: In 2009, Sisler Builders opened its Energy Division to focus on helping Vermonters make their homes more efficient, healthy, and comfortable. We offer energy audits, energy retrofit services, and "green guidance" primarily in the Waterbury, Stowe, and Morrisville areas.

What projects do people try to do themselves that really should be done professionally?

MD: Dense-pack cellulose and two-part spray foam insulations should be installed by professionals. The required equipment is expensive and both can be very tricky to install properly without the proper training and a lot of experience. Most of the work happens in the attics, basements, and crawlspaces which most people find to be rather unpleasant places to work as well. Also, getting a professional energy audit prior to starting retrofit work will help you spend your money more wisely and ensure the improvements you choose do not create unsafe or unhealthy conditions in your home or commercial building.

If you could only choose one type of project to reduce someone's carbon footprint or improve efficiency, what would it be and why?

MD: If I could only recommend one improvement to a homeowner, it would almost always be comprehensive air-sealing. Significantly reducing air leakage in a home not only saves a lot of money on heating bills, but it typically makes the home much more comfortable and reduces dust, spiders, insects, rodents, and outside noise! Most people do not appreciate what a big difference air-sealing can make until they feel it for themselves. From cold and drafty to warm and cozy!

Members of Sisler's Energy Division crew are (lt to rt): Chuck, Lou, Kerson, and Mike D'Muhala. (Courtesy photo)

Can you share one job project that really stands out to you as moving from inefficiency to efficiency?

MD: I cannot think of a single project that stands out above all the others we have done. I have performed over 1,400 energy audits, and our crews have performed several hundred energy retrofit projects. Some projects are very small, just a few hundred dollars, and some are as much as $60-70,000! Almost without exception, our customers are thrilled with the felt improvement and savings they see.

What is it in your field of specialty is most valuable (related to energy efficiency or the EEN) that our readers ought to know about?

MD: I think the energy audit and evaluation is the most valuable service we offer our customers. An audit helps them make informed decisions about how best to spend their money to achieve their specific efficiency and comfort goals. Without the necessary knowledge, it's very easy to spend a lot of money going down the wrong path.

Why should people use an EEN member over someone else?

MD: Choosing an EEN member contractor ensures they are committed to high standards, excellent service, and the latest technologies and techniques.

What are the best ways to finance projects (or what incentives are available) for residential or commercial projects?

MD: Some banks offer very low or no interest on qualifying energy loans. Efficiency Vermont historically offers rebates and incentives towards many energy saving improvements. Currently, they are offering a rebate on air-sealing and insulation upgrades of 75% project cost up to $4,000 (and up to $9,500 for income-eligible Vermonters)! Most electric utility companies offer additional rebates as well. Specifics often vary from town to town.

At a typical retrofit project, Sisler's Energy Division vacuums old insulation out of an attic in preparation for air sealing the attic. (Courtesy photo)

What are some questions you recommend customers ask when selecting someone to do work to meet energy efficiency goals?

MD: Are you an EEN member contractor? Are you BPI (Building Performance Institute) Certified? Will the work you do qualify for Efficiency Vermont rebates? ♻

Meriden, New Hampshire's New Library Showcases an Energy Efficient Building Design

G.E.T. *staff*

The construction of the Meriden, New Hampshire library on 22 Bean Road presented an ideal opportunity for energy-efficient new construction through the Regional Greenhouse Gas Initiative- funded NHSaves Municipal Program and partner utility Liberty. The project included demolition of the 1965 building and its replacement with a new 3700 square foot, energy-efficient building on the same piece of land. The old library was not in compliance with accessibility standards and had poor occupancy comfort.

The Meriden Library is a high-performance building and operates 100% on electricity.

The town adopted a "Ready for 100" (R100) initiative in 2018, which is a commitment for town facilities to move to electricity from 100% renewable sources by 2030, and 100% of all energy from renewables by 2050. To meet the R100 goals, the new building would be fully operated from electricity. Liberty, through the NHSaves program provided construction and technical assistance incentives for design modeling enabling value-based tuning of the design to meet the R100 goals.

In March of 2021, the town passed a warrant article to remove the existing building and replace it with a new facility. The charming little brick building served its community well for over 50 years. Over time, the needs of the community changed and the library became outdated. The building had asbestos, was not in compliance with current accessibility standards, and the HVAC system and insulation needed to be updated. Therefore, it was more practical to replace the facility than to renovate it.

The project began in November 2021 with the demolition of the old library, including hazardous materials abatement. By the end of 2021, the new site had been excavated and the foundation, footings and walls poured. GeoBarns began construction in the spring of 2022. The library opened its doors on April 10, 2023.

The new library met energy efficiency goals by being well-insulated with a R15 insulated foundation (stem wall with thermally isolated slab on grade), R34 exterior walls, and R57 roof. Insulation work was performed by Quality Insulation of Meredith, NH. Triple-glazed windows with a U-factor of 0.17 by Wythe were installed and energy efficient doors by Kohltec were used. The mechanical systems provide heating, cooling and ventilation in three zones using two very highly efficient air-sourced heat pumps. One is a two-ton ductless system. The other is a 3.5-ton, ducted system. To ventilate they installed four ERV's. Another energy efficient measure is LED lighting. Other factors considered in building a highly efficient structure reducing the carbon footprint of the products used in the building and reducing the overall size and energy demands of the building.

Cont'd on p.29

Demolishing the original library. (Courtesy photos)

Meriden's New Library

Cont'd from p.28

Geobarns believes in vapor open, air- and water-tight assemblies, and used products to achieve this.

A post construction blower door test resulted in ACH(50) of 0.18. This exceeds state code requirement and the threshold for a high-performance building. Achieving these results requires getting the whole team on board, starting from the design team specifying the right details on the plans, project managers and superintendents communicating and checking installation standards, well-practiced installation and care for the products, and attention to detail from the team of carpenters and insulators executing the work. It also takes awareness and care from the other trades to make sure the assembly stays intact and is not damaged in the process of their work. The estimated energy savings are 18MWh per year and lifetime savings of 276MWh. A one-year post occupancy performance check will be conducted in the spring of 2024.

Geobarns also ensures the build environment provides a connection to the natural environment. Geobarns consulted with Resilient Buildings Group to incoporate biophilic design principles into the design. RBG worked with Geobarns to review the architecture of the space, its connectivity to outside through windows, patio spaces, and natural light, through features such as the monitor cupola. Geobarns worked with the library design committee to utilize its material palette with various types and textured woods, wall finishes and colors to provide connection to these natural materials inside the space as well.

Additional project highlights include improved safety for pedestrians and vehicles including curbing and sidewalks, two handicap-accessible bathrooms, a 30-person community room, a smaller meeting room, and an abundance of natural light. The building not only serves as a library but as a community meeting space.

The library interior includes shelving that is ADA-compliant. It was designed to include an abundance of natural lighting.

The cost of the project was just under $1.2M. The project was funded entirely by donations, existing funds, and support from Liberty's NHSaves program. Resilient Buildings Group helped to coordinate NHSaves funding for the project with Liberty. This program provided $18,300 in RGGI funded incentives for construction, technical assistance, and post-occupancy assessment.

Library Trustee and Treasurer Jennifer Lenz said, "Liberty and its NHSaves program supported technical assistance in the areas of energy modeling, design review and post construction analysis which was key to our integrated design process. It enabled us to make informed choices, resulting in a comfortable and efficient building delivered within our budget, especially with the added help of the incentive money. The Meriden Library is a beautiful addition to our community, and we appreciate everyone at Liberty's NHSaves and Resilient Buildings Group who helped along the way." Lenz added, "I also want to report that as the person who pays the bills for the libraries, I have been pleasantly surprised at how low our electricity bills have been so far."

This project provides an excellent example of how energy efficiency can be integrated into projects that meet a variety of community needs, ensuring reductions of energy use, carbon emissions and energy bills for many years to come. ♻

UltraTech Lighting -- Magnetic Induction Solutions

George Harvey

Snow-Bright in action. (Ultra-Tech Lighting)

Artificial light is taken for granted. We read and work by lights without a second thought. We drive under street lights, play sports under athletic lights, but we rarely realize that our health and performance as well as the environment are affected by the spectrum that electric lamps generate. The same electromagnetic energy we see as "light" is energy used to take X-Rays or to generate germicidal ultraviolet wavelengths. We may be aware of the varied purposes, because we buy them to use, but what do we really know about lights?

Bulbs have been changing through the years; from the first Edison incandescent lights to fluorescent, metal halide, high pressure sodium, and finally, light emitting diodes, or LEDs. However, a renowned scientist and inventor named Nikola Tesla invented a unique way of generating all kinds of electromagnetic energy using "induction fields." He made fixtures that were extremely energy efficient and long-lasting. Tesla called his invention "The Forever Bulb" because it had an enormous lifespan. It was the most sustainable form of generating artificial light, but sustainability was not the business objective in 1890. Thomas Edison called Tesla a fool because he (Edison)wanted a bulb that would inevitably burn out and need replacement. Edison also wanted a bulb that would use a lot of energy that the power companies could charge for. My, how times have changed

Magnetic induction lights are not LEDs. Although Tesla conceived using magnetic fields to generate efficient lighting in the late 1800s, the business model was to create limited life inefficient bulbs. More recently, it was discovered that stimulating diodes in a certain way would cause them to emit light; hence, the light emitting diode, or LED was developed. LEDs are very efficient, but the technology comes with an environmental price and significant health issues. Perhaps you have heard that LEDs flicker at high speeds which causes "strobe effect." The flicker rate is above our conscious vision, but is still perceived by our brains. This flicker can cause migraine headaches and even "strobe epilepsy." LEDs emit a highly blue-biased spectrum that can disrupt our circadian rhythm and disturb sleep patterns. The flicker can distort our depth perception in a way similar to how strobe lights cause stop action we may have experienced in a disco. These problems do not exist with Tesla's "old" magnetic induction technology.

From an environmental perspective, LEDs are very difficult to recycle because they have hazardous compounds like aluminum gallium nitride (AlGaN), aluminum gallium indium phosphide (AlInGaP), aluminum phosphide (AlaP), indium gallium nitride (InGaN), aluminum indium gallium phosphide (AlInGaP), gallium arsenide (GaAs), and aluminum gallium arsenide (AlGaAs). While each LED may have a small amount of these elements, the sheer number of lamps that will eventually make it to landfills creates a serious pollution problem. So, LEDs are not environmentally friendly or sustainable in a holistic sense. Nikola Tesla's magnetic induction bulbs don't contain these harmful substances. There is a small amount of mercury, but it is encapsulated into a solid amalgam that can be recycled and will not leach into the environment. Thus, Tesla invented the ideal lighting technology for our times, back in 1890.

You may ask, "How can I buy magnetic induction lights?" Indeed, these fixtures have not been widely manufactured or promoted. It is a technology that was skipped over in favor of seeking something "new." However, in December, we received a note from Ultra-Tech™ Lighting, explaining the advantages of using magnetic induction lights (MILs) over LEDs. Realizing that LEDs have major drawbacks, Ultra-Tech™ decided to concentrate on reviving and modernizing MILs to create a more healthful and environmentally sustainable, highly efficient artificial light source. In their quest to recreate Tesla's technology, Ultra-Tech™ discovered ways to customize the

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Our Climate System is Moving Out of Control

Dr. Alan K. Betts

The last few months in New England have seen increasing wild weather as a series of major storms have moved up the east coast from Florida into Canada bringing winds and major flooding to New England. The gulf between the climate system of the past and the present is widening on both local and on global scales. Last year the mean annual global temperature reached a new high that stunned climate scientists, breaking the previous record not by a small 0.01°C but by 0.15°C. The global mean temperature increase has now reached the +1.5°C threshold that nations had promised to avoid. Much higher values lie ahead where we know the consequences will be catastrophic.

Across the world the nations met in December for the annual COP28 gathering in a fossil fuel country, Dubai with President Sultan Al Jaber as the chair, to discuss what commitments they would make. The contrast with the ongoing reality seems to me a bizarre joke. As usual there were six hundred lobbyists from the fossil fuel empire present to ensure that their interests were protected. Many fine speeches were made and a list of 'promises' was cautiously drafted.

A historic decision was made to establish a **Loss and Damage Fund** to help countries address the irreparable impacts of ongoing climate change. Nations committed hundreds of millions of dollars, but of course globally the catastrophic damage to island nations as sea levels rise, and poorer regions of the world who are not responsible for climate change, are far larger.

*Heavy rains in July 2023 caused flooding throughout New England. Route 113 in Madison, NH was damaged with thousands of yards of gravel washed across the road making it impassable. (Rachel Sharples/*Conway Daily Sun*)*

A new **Declaration on Climate and Health**, signed by 124 countries, underscored the need to prepare healthcare systems for climate impacts and emphasized government responsibility for public health. Very true, but as long as capitalism and the rich countries do not act to drastically reduce emissions of CO2 and methane, health impacts will increase rapidly.

The COP28 summit in Dubai fell short of requiring the world to phase-out oil, coal and gas Instead the report used weaker language, proposing to make the transition away from fossil fuels. We have promised to do this for years but actions have been far too limited, so that global temperatures will rise for decades.

Let us step back and honestly review the climate crisis which has a long history. I realized there was a crisis in 1976 when I challenged the official framework that scientists should deal just with the facts, because the full spectrum of economic and social issues was beyond their expertise. I argued that for environmental issues, researchers would be wise to face their responsibilities up to the global scale. My PhD training from the world's greatest observational climate scientist (Professor Frank Ludlam) was simple, "If something is critical and you understand it, you are responsible." So, in 1976, I took on the responsibility for understanding the global climate system. In 1978, the chief scientist of Exxon-Mobil told management that they were on a path to double CO2 and this would destroy much of life on earth. His advice was ignored, and the fossil fuel energy companies have used their huge financial resources for decades to bribe politicians in the U.S. government not to interfere. Independent observers estimate that globally we are now on the path to destroy half the species on earth to keep the profits rolling, and perhaps kill billions of people, including some of our children and grandchildren.

What they did not know, however, was that on a much higher long-term level, Mother Nature/Creator has responsibility for life on earth. She decided a few years ago to intervene to stop the massive destruction of species, and flood the coasts as necessary as a check on capitalism. I discussed this in the October *G.E.T.* article. However, understanding this is very difficult for our society which for centuries has had a male power framework. This was created by Emperor Constantine at the 325AD Council of Nicaea, who needed it for warfare, and the suppression of women and indigenous people.

So, society struggles to forecast the local and seasonal weather using traditional concepts such as the current El Nino with the historic ones as reference. However, the climate events we are seeing on the coasts and inland across the US are more extreme than what we have seen previously. Yes, we still urgently need all our creative vision to reduce fossil fuel usage and greenhouse gas production from many diverse sources. However, because of bribery and corruption we have waited too long, and now we must prepare for the consequences.

We must explain these critical issues to the younger generation who have to deal with them. The key issue is deceptively simple. If you consciously accept the role of the creator in managing life on earth, she knows at once you have joined her, and then she can help you – mostly on the intuitive level. I suggest sitting outside in the woods and connecting with the life around you that is already connected to her.

Dr. Alan Betts of Atmospheric Research in Pittsford, VT is a climate scientist. See alanbetts.com. ♻

The World Is Burning Around Us, Elmo

Cont'd from p. 1

increased storm frequency and severity, most recently seen in the U.S. in California and Oregon. The addition of increased rainfall in lands parched from years of drought leads to dangerous flooding; rain on saturated hills triggered a staggering number of landslides. The drought and other changes impacting agriculture also contribute to increased migration out of developing countries nearer the equator. Increasing heat and heavy periodic rains are affecting farmers in New England. Warming atmosphere also plays havoc with snowfall, decreasing in some areas and increasing in others. See the article on page 20 about the causes and effects of the drop in our region's snowpack. New England's ski resort managers know the phenomenon well. We've heard, too, about the effects of warming oceans on coral reefs and sea level rise including the northeastern coastlines causing much erosion and damage.

Now this is getting expensive

The total annual cost of wildfires -- made worse by climate change in the U.S., including property damage, insurance payouts, timber loss, diminished real estate values as well as direct firefighting --is estimated to be between $394 and $893 billion. Using the lower figure and projecting the costs for five years with a conservative discount rate, the net present value of those costs is about $1.5 trillion dollars, enough to justify taking some pretty hefty counter measures right now.

The 2024 budget for the Department of Agriculture Forest Service's wildland fire and hazardous fuels management totals $2.97 billion, which is $647 million, or 28% above the comparable 2023 level.

And we know what to do about it

Burning fossil fuels is the leading cause of the greenhouse effect warming the planet. It is true that misguided forest management practices in the last century contributed to the fuel load available for conflagrations, but warming the globe has significant multiple impacts, from drought conditions to reduced disease resistance of trees and the future of their existence.

So, Elmo, we know what the leading sources of greenhouse gas emissions are: from fossil-fuel powered transportation, and home and water heating and cooling, to agricultural practices. And we know the actions we can take to mitigate their generation. *Green Energy Times* is all about the solutions to mitigate further damages resulting from the continued use of fossil fuels for transportation, electricity, and heating and cooling buildings.

Clockwise: Lahaina burning. (U.S. Coast Guard photo, via Wikimedia Commons); On May, 17th, 2023, the day this photograph was taken, the air quality health index from the Government of Canada measured 10+, the highest rating possible. (Wikipedia.org/Dwayne Reilander); Vehicle congestion on route N-55 in Chile due to wildfires in February 2023. (José Joaquín Cortes, CC BY-SA 4.0, via Wikimedia Commons)

Our articles show readers how they can reduce their carbon footprint, including choices for housing and transportation. Our advertisers also provide goods and services readers can use to achieve their personal CO2 emission reduction goals.

Martin Wahl has worked in biofuels since 2006, currently with Lee Enterprises Consulting, a large bio-economy consulting group. Dividing his time between CA and NH, he serves on Corte Madera, CA's Climate Action Committee and is a Newfound Lake Region Association member. ♻

Can We End the Climate Crisis in One Generation?


John Bos

There is a growing body of scientists that believe that we the people have passed the tipping point with respect to mitigating global warming, much less turning it around.

Paul Hawken is not one of them. Hawken is an environmentalist, entrepreneur, and bestselling author of eight books that have been published in thirty languages in more than fifty countries and have sold more than two million copies. Hawken is a renowned lecturer who has keynoted conferences and led workshops on the impact of commerce upon the environment and has consulted with governments and corporations throughout the world.

In the December issue of *Green Energy Times*, I introduced Hawken's (and others') current conception of how to end the climate crisis in one generation. Not just meeting the slippery goals set for 2030 and 2050. And noting that ending the crisis does not complete the challenge of global warming. That is a century-long commitment. Ending the crisis means that by 2030, an important majority of humanity will come to realize the breadth and depth of the crisis and the possibilities it offers for human and ecological transformation.

To this end, Hawken and fellow environmentalists have created "Re generation," a radically new approach to the climate crisis, one that weaves justice, climate, biodiversity, and human dignity into a seamless tapestry of action, policy, and transformation that can end the climate crisis in one generation. They are a team endeavoring to create a comprehensive list of solutions and challenges about how to address the climate emergency and how to regenerate planetary ecosystems. These are more than just descriptions. On the Re-generation web site is an information option called Nexus (https://regeneration.org/nexus). I urge you, no matter what you know and want to know, to check out Nexus. Each entry explores what can be done on all levels of agency, including individual, community, classroom, city, company, and government. For each topic, the team curate organizations that are actively engaged, describes actions that can be taken, links to educational opportunities, and provide examples of transformation. Hawken and friends work collectively and collaboratively with the goal of sharing their research and discoveries with you.

See the list of re-generation topics on this page, each consisting of action items for individuals, groups, researchers, landowners, companies and governments. In each category is a list of key players, reading materials and an invitation for you, the reader, to share your knowledge. It is to my eyes and sensibilities, a mind- boggling and more than welcome environmental resource.

There is also a weekly offering entitled "The Waggle," that offers compelling and inspiring stories about the regeneration and restoration of life on Earth, solutions to the climate crisis curated and authored by writers and researchers at Project Regeneration. The newsletter is named for the waggle dance, what honeybee scouts do to show the hive where to find the nectar.

Finally, Hawken's book, *Re-generation: Ending the Climate Crisis in One Generation* available on a half dozen web sites.

Nowhere else in my research have I discovered such an enormous treasure trove of environmental information. You may not agree with some of Re-generation's findings and recommendations, but I think you would be challenged to make a compelling rebuttal in response to their research.

In addition to serving as a contributing columnist for Green Energy Times, *John Bos is a long-time columnist for the* Greenfield Recorder *with his bi-weekly "Connecting the Dots" columns. His columns may be accessed by Googling "muckrack articles by John Bos. Please send comments and questions to John Bas at* john01370@gmail.com. ♻

82 Sources of Climate Change Action Items

Land
Biochar
Degraded Land Restoration
Enhanced Weathering
Freshwater
Fungi
Pastoralism
Rainmakers

Forests
Afforestation
Agroforestry
Bamboo
Boreal Forests
Fire Ecology
Palm Oil
Peatlands
Proforestation
Tropical Forests

Oceans
Coral Reefs
Mangroves
Marine Protected Areas
Seaforestation
Seagrasses
Seaweed Farming
Tidal Salt Marshes

Wilding
Beavers
Grasslands
Insects
Keystone Species
Pollinators
Rewilding
Wetlands
Wildlife Corridors

Food
Agroecology
Animal Integration
Asparagopsis
Azolla Fern
Clean Cookstoves
Compost
Food Apartheid
Localization
Perennial Crops
Plant Diversity
Regenerative Agriculture
Silvopasture
System of Rice Intensification
Vermiculture
Wasting Nothing
Women and Food

The City
Buildings
Carbon Architecture
Fifteen-Minute City
Girls Education
Green Cement
Nature of Cities
Net Zero Cities
Urban Farming
Urban Mobility

Energy
Agrivoltaics
Electrify Everything
Energy Storage
Geothermal
Green Hydrogen
Heat Pumps
Hydropower
Microgrids
Offsets
Onsets
Solar
Wave and Tidal Energy

Transportation
Electric Vehicles
Micromobility

Challenges
Banking & Finance
Clothing
Deep Seabed Mining
Desertification
Global Fishing Fleets
Maritime Shipping
Migration
Plastics
Politics Industry
Refrigerants
Ultra-Processed Foods
War Industry

VT Environmental Priorities

Cont'd from p. 3


Flooded farmland in Cambridge, VT after the July 2023 flooding. (Greta Hasler)

affordable, smart-growth housing solutions that help alleviate the housing shortage while maintaining the protection of our vital natural resources. We can increase the efficiency and effectiveness of local participation, better integrate modern considerations in development review processes, and improve the alignment of local and regional planning goals. The Legislature has been considering how to modernize Act 250 for a number of years and it is time to act.

Finally, this year's Common Agenda identifies steps the Legislature must take to reduce Vermonters' exposure to toxic chemicals, implement the state's Environmental Justice Law, finish the work of updating the Bottle Bill, and ensure a healthy democracy for all. These are all crucial priorities to keeping our communities safe, healthy, and equitably engaged.

While we recognize that our state faces immense and immediate challenges, and that the Legislature has an enormous number of competing priorities to address, we are hopeful that this collaboratively-produced Environmental Common Agenda can provide a blueprint for State House action that makes an impact. This agenda outlines clear and actionable steps that Vermont can take this year to address climate change, build more smart growth housing, protect our natural resources, shore up our democracy, and provide a healthy future for all Vermonters. We will hold the Legislature accountable to these actions and continuing our work on behalf of our communities and environment.

Lauren Hierl is executive director of Vermont Conservation Voters and has been an environmental advocate for over two decades. She is currently serving her third term as a Montpelier City Councilor. ♻

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Students Call for Most Effective Climate Policy

Katharine Gage

Despite recent advances in climate legislation, the Earth is still on track to reach 3.3˚C of warming and an atmospheric carbon dioxide concentration of 1000 parts per million (ppm) by the end of the century. The last time the carbon dioxide concentration in the atmosphere was that high, sea levels were 70-90 meters higher than they are today, and the climate was not supportive of life on Earth as we know it. Recognizing the urgency of the problem and the need for powerful, effective climate legislation, students across the country are calling on Congress to enact a Carbon Fee and Dividend policy.

Students at the College of William and Mary hold Carbon Fee and Dividend Movement signs to help create the political will for the most effective climate policy. (Emily O'Keefe)

According to the Intergovernmental Panel on Climate Change (IPCC), carbon pricing is necessary to hold warming to 1.5˚C. Returning all the money collected from a carbon fee on fossil fuel production to households on an equal, per capita basis ensures that a high enough carbon price can be achieved while protecting low- and middle-income families and marginalized communities. Over *3,500 U.S. economists* declared that a Carbon Fee and Dividend approach is the most effective solution to reduce carbon emissions at the speed and scale necessary – it would lower U.S. emissions by *90% by 2050*, putting the country on track to achieving our net zero goal.

A Carbon Fee and Dividend bill was recently re-introduced in Congress by Rep. Salud Carbajal (CA-24) as H.R. 5744, the Energy Innovation and Carbon Dividend Act. Despite the expert consensus around Carbon Fee and Dividend, more political will is needed for the bill to pass through Congress. High school and college students are helping build the popular support necessary for the legislation of this important policy through a collective action movement.

The Carbon Fee and Dividend Movement began last spring when William and Mary College student Emily O'Keefe displayed a sign in the dining hall that read, "Help Save Our Planet – WRITE CONGRESS to support a CARBON FEE AND DIVIDEND – *bit.ly/writecongresshere*." Over the course of the semester, more and more students joined in making Carbon Fee and Dividend signs to display on their computer cases and dorm doors, and the movement had a snowball effect. The students also spread the message by putting up flyers, writing on sidewalks in chalk, and giving presentations to classes and clubs. By the end of the semester, nearly every student at William and Mary knew about the most effective climate policy, and many had written to Congress expressing their support. "I feel like this has been the most impactful thing I've done, maybe in my life", said O'Keefe, the movement's founder.

The Carbon Fee and Dividend Movement is growing rapidly and is now active or starting up at eleven schools, including Bowdoin College, the University of Vermont, and Yale University.

I joined the movement last fall at Bowdoin with the Citizens' Climate Lobby club. We covered the campus with flyers and passed out stickers with the simple message to write Congress about the most effective climate policy. It was very rewarding when we were tabling at school and asked people walking by if they had heard of Carbon Fee and Dividend, and many students whom we did not even know said yes. Most college students I know are deeply concerned about our future because of climate change, and with our busy school schedules, offering quick actions to email Congress and display a sign or sticker to promote the most effective climate policy has been very successful in increasing engagement in climate activism.

Students at Bowdoin College display signs while studying in the library that encourage their peers to email Congress in support of the single most effective climate policy – a Carbon Fee and Dividend. (Katharine Gage)

There are many easy ways to get involved and support the Carbon Fee and Dividend Movement. Students can join the movement at *cfdmovement.com*. Anyone can email Congress about Carbon Fee and Dividend at *bit.ly/writecongresshere*, follow us on Instagram @carbonfeeanddividend, and make a sign and show it where you can.

Katharine Gage is a freshman at Bowdoin College and has volunteered with Citizens' Climate Lobby (VVL) for five years. She co-leads a CCL NH and a Bowdoin chapter. ♻

Elmore Roots' Permaculture Know-How

A Choice to Step Outside or Not

David Fried

The bumblebee is pulled by a thirst to pollinate flower to flower, just as her ancestors were, in an ancient dance. I reach up into the pear tree and fix my eyes on the one pear I really want to pick and bring to my daughter. I bring down three: one for each daughter and one for my wife. There is light and goodness in these pears, and I want to share this.

Just out the window is the great green world of spring. Where the winds were wailing at the wall of my window just a few weeks ago, the spring breezes are whispering to me, "Come on, come outside, let me wrap my little arms around you."

I have choices. I can sit at my laptop screen and write to people and write new poems and stories. I can cook a meal and feed my family. I can lean back in my easy chair and read a book that I have been looking forward to.

The little light spring breeze grabs my ponytail and waltzes me right out the porch door.

I am helpless now. The ground gives to my footsteps, and I am walking up the hill in the forest behind my house. There is the witch hazel bush I planted a few years ago. It waves in the breeze but will not blossom until the autumn time. A young mulberry tree leans from side to side singing its song it has been mulling over for months now. I can only hear it when I stop and notice its young graceful beauty.

The chickadees jump and hop within the thick cedar trees that I always leave full for them. On the coldest winter days, I put my head out the window and it is just me and them way up in their miniature forest within their primeval dark green haven.

The kolomikta kiwi vines, one male and one female cover an arbor and make a very shady place to be out of the sun in the summertime. But now they are just unrolling their leaves, one at a time. Soon their vining nature will overcome all attempts to tame them. They will be reaching out and searching for a new avenue for twirling around. It could be a pole, a peach tree, my arm if I stand here too long.

Last year, I planted a very hardy Russian quince tree cultivar called "aromatnaya" which I think means "really full of fragrance." I also planted a medlar tree. I am hoping this tree will grow strong and bring me fruit that I tasted once at a co-op food store in Brattleboro, Vermont. It looked like a little brown wrinkled soft crabapple, but it had a flower end top like a persimmon. The flavor reminded me of very good apple pie.

Climbing up on this hill where sheep and cows once roamed, I am surrounded by a few old pines and a lot of maples and poplars. When I see a rare oak, I am happy because I know this oak can feed a lot of animals with its mast . The other trees feed a lot of birds and insects too, but a cache of acorns is easier for us two-legged ones to wrap our imagination around.

I walk along the ridge now, looking at the town below, our house down there, and what I have planted. I lean against a tree where I have a view of the Worcester mountains. The spring warmth rises up in the valley and the hills way beyond look like they have steam escaping from their summits.


Painting by Joyce Dutka

After a long cold winter of hibernation, I am so glad I made the choice to step outside for a walk. I could have opened a bottle of wine because new research shows it helps lower cholesterol levels (from the skins in the grapes especially). But I have time for this later. I feel the warmth of this day on my forehead and on my hands. This day, this warm gift of life is to be tasted and held close. I want to be wise enough to lean into it and give it something.

How many fruit trees and nut trees will I plant this spring? How many people will I show that you can plant a blueberry bush once and can harvest the fruit for thirty years? How often will I really listen and hear the person who is next to me asking me about growing, about harvesting, about life?

Each day I can be a guy that makes the world a little better. The laptop is a good place to write and to stay in touch with friends around the world. The hilltop and the treetop are a good place to be alive, breathing and dancing with the bubbling up energy I find all around me now. It is all waiting just outside the window. Come on out.

David Fried is a poet and garden writer who also grows trees at Elmore Roots Nursery in northern Vermont. ♻

NEW HAMPSHIRE ENVIRONMENTAL EDUCATORS RECEIVE A $15,000 GRANT FOR AMBITIOUS NATURE PLAN

New Hampshire Environmental Educators (NHEE) receives a grant from the New Hampshire Charitable Foundation to strengthen the organization's capacity to continue their work towards a New Hampshire where all people value and feel connected to our natural spaces, are environmentally literate, and act as social and environmental stewards in their communities.

NEW HAMPSHIRE CHARITABLE FOUNDATION

NHEE recently received a $15,000 grant from the New Hampshire Charitable Foundation. The grant will help further NHEE's mission to inspire connection to our natural world by supporting high-quality environmental education and advancing environmental literacy by covering operational costs to complete an ambitious strategic plan.

There are three main areas to the plan. The first was to hire an Administrator for the first time in NHEE's 45-year history. The hiring was made in November 2023. With this hire, the board of directors can focus their efforts on the other two parts of the plan, fundraising and diversifying the board. With funding from the New Hampshire Charitable Foundation, NHEE will be able to update its website to increase visibility to potential board members and supporters, provide professional development to board members to help meet fundraising goals, and cover the day-to-day operations of a non-profit. ♻

Students Access the Outdoors through NHEE'd To Get Outside Grants

The New Hampshire Environmental Educators awarded over $30,000 in NHEE'd to Get Outside grants to 23 schools and organizations for 2024. Schools and nonprofits receive this funding to help their students access the outdoors whether it is for admission and transportation for field trips to nature spaces, snowshoes for winter exploration or science tools for outdoor learning.

NHEE'd to Get Outside Grants were awarded throughout the state. "We are so happy as an organization to be able to support this grant program as funding for access is one of the greatest barriers to getting students outside" explains Judy Silverberg, a NHEE Board member. This program has been in place since 2018 and has grown in its ability to provide funding to what it is today. Last year over 1,600 students benefited from grants ranging from $200 to $2000. Each project awarded directly supports New Hampshire students learning outdoors.

"THANK YOU! WHOOOOO!!! This is awesome, thanks so much for this opportunity to grow our Environmental Science program here at Hollis Primary School! So very, very exciting!" was one NHEE'd to Get Outside grant recipient's response when they found out they were granted funding.

The NHEE'd to Get Outside Grants are supported by members of the New Hampshire Environmental Educators, an anonymous Maine foundation, community donations, and other grants and awards received by New Hampshire Environmental Educators. Currently, the organization is halfway to raising funds to meet a $10,000 challenge by May 31, 2024. To support the goal of helping students access the outdoors and learn more about this program go to nhee.org

The organizations awarded grants for 2024 include: Stark Village School, Lisbon Regional School, Broken Ground School, Wheelock Elementary School, Beaver Meadow School, Tiny Tots Preschool, Deerfield Community School, Harris Center for Conservation Education, Manchester High School West Outdoor club, Stafford School, Hollis Primary School, Edward Keen Elementary School, Danbury Elementary School, Mount Washington Observatory, Stonewall Farm, Unitarian Universalist Friends of Refugees, Lake Sunapee Protective Organization, Timberlane Regional School, Circle Program, Sanborn Regional School, Nashua PAL, Southeast Land Trust, and Kearsarge Food Hub.

New Hampshire Environmental Educators is a network of individuals and organizations working to inspire connections to our natural world by supporting high-quality environmental education and advancing environmental literacy. ♻

RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions. **www.350vermont.org**

American Council for an Energy-Efficient Economy: aceee.org

American Solar Energy Society (ASES): www.ases.org

Backwoods Solar: Specialty: solar, off-grid - **www.backwoodssolar.com**

Carbon Tax: carbontax.org

Clean Energy NH: www.cleanenergynh.org/

CO2.Earth: See emissions harms, scientific advice, and pathways to follow. www.co2.earth

CommuteSmartNH - https://commutesmartnh.agilemile.com/

Consumer Guide to Home Energy Savings, Heating, Appliances, Refrigerator Guide, Building Envelope, Driving: http://aceee.org/consumer

Dept. Public Svc. (CEDF): publicservice.VT.gov/energy/ee_cleanenergyfund.html

Dsireusa.com: Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency. **www.dsireusa.com**

Efficiency VT: A must-go-to site for immeasurable amounts of info. **www.efficiencyvermont.com**

Energy Efficiency & Renewable Energy Clearinghouse (EREC): eetd.lbl.gov

Energy Guide: Unbiased advice about today's energy choices. Find ways to save, lower your bills & help the earth's environment - **www.energyguide.com**

Energy Star Federal Tax Credits: www.energystar.gov/about/federal_tax_credits.

Federal Energy Regulatory Commission (FERC): www.ferc.gov

Fossil Fuel Freedom: Group working to make Vermont's energy plan 100% free of fossil fuels:

To join this group go to: **groups.google.com/group/fossil-fuel-freedom-**

Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home. A lot of great information! - **hes.lbl.gov**

IREC/ Interstate Renewable Energy Council: RE educational info. **www.irecusa.org**

NABCEP/ North American Board of Certified Energy Practitioners: This organization that tests & certifies PV system installers. Individuals are Certified, companies are not. **www.nabcep.org**

NESEA/ Northeast Sustainable Energy Assoc.: www.nesea.org

National Association of Energy Service Co. (NAESCO): www.naesco.org

National Renewable Energy Laboratory (NREL): www.nrel.gov

NeighborWorks® Alliance of Vermont: Low-cost energy loans - **www.vthomeownership.org**

New York Solar Energy Industries Association/NYSEIA www.nyseia.org

New York Solar Energy Society (NYSES): www. nyses.org

NFRC independent rating & labeling system for the windows, doors, skylights **www.nfrc.org**/

NH Energy Divison: www.nh.gov/osi/energy/index.htm

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org

SEIA/ Solar Energy Industries Association: The SEIA Tax Manual to answer your solar related tax questions. **www.seia.org**

SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

Solar Jobs: Listed by city, state, and district, **SolarStates.org**

Solar Power Rocks: Impressive data and info ,including per state. www.solarpowerrocks.com/

Solar Store of Greenfield, MA Stock & install a wide variety of solar & environmentally friendly technologies. **SolarStoreofGreenfield.com**

Tax Incentives Assistance Project (TIAP): www.energytaxincentives.org

The Office of Energy Efficiency & Renewable Energy (EERE): develops & deploys efficient & clean energy technologies that meet our nation's energy needs - **www.eere.energy.gov**

Vermont Energy and Climate Action Network (VECAN): works to start and support town energy committees as a powerful, people-powered response to realizing a clean energy future. www.vecan.net.

VPIRG: understand the clean energy resources available to VT - **www.vpirg.org/cleanenergyguide**

VT Energy Investment Corporation (VEIC): nonprofit organization that issues home energy ratings for new & existing homes. 800-639-6069 - **www.veic.org**

Vermont Passive House: www.vermontpassivehouse.org/Resources/

Weatherization, Energy Star & Refrigerator Guide: www.waptac.org

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ADVERTISERS INDEX

Evolution, Perception and Vitamin D

Larry Plesent

Long ago our more apish ancestors had to determine which green leaves and which red berries were the ripest. They learned to quickly choose one item from a field of very similar appearing objects. This ability to differentiate underpins the way our brains work and is thus baked into the biases and methods through which we perceive, evaluate and alter the world.

Nature does her work in systems or "bundles." Human brains tear apart that bundle and analyze its parts as unique and distinct entities. This analytic approach to understanding the world has resulted in huge, snowballing leaps in technology and in the general knowledge base.

It has also contributed to our extremely unbalanced approach to everything from energy generation, food production and house building, to allowing the proliferation of single use products and the world-wide cancer epidemic that is the inevitable result of all that lopsided thinking. It is our greatest tool and, unless we all work together nicely, has the capacity to destroy all that it creates.

This bring us to our discussion on vitamin D, a nutrient so important our skin uses sunlight to make it for us. Conventions dictate the daily covering up of skin surfaces (leaving our all-important faces exposed). We only drop the convention when taking a vacation from our "real" lives. The more "on vacation" we are, the more skin we can comfortably expose in public without risking sexual advances. If this seems bizarre to you join the club.

The consequences of too little vitamin D are visually obvious; our bones become soft, brittle, and eventually deformed. The best science we have on vitamin D relates to its relationship to calcium metabolism and bone structure. That's why we put it into milk, a food source notoriously low in it. I must assume that babies are born naked for a reason, as mother's milk is also low in vitamin D.

One very large and long-running study found that too much vitamin D increased the prevalence of bone fractures. If we need another example of the wisdom in moderation here it is. Vitamin D good. Too much, not so good.

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This provides a sound biological basis for the darkening of human skin through tanning and evolution. If your more recent ancestors came from the north your skin is light. If they came from the equator, it is dark. Middle regions tend to be shaded in between. Simple and logical. If our collective brains would allow us to stop focusing on our minor differences, peace might actually break out in the world.

Vitamin D is so critical to human functioning, so baked into our metabolic processes, if it were discovered today, we would not call it a vitamin, but something closer to a hormone or even a building block for making a human. Vitamin D is involved in glucose metabolism and insulin uptake, thyroid and parathyroid function, hormonal balance, mood regulation, adrenal and stress response, calcium and phosphorus metabolism, reproductive health, and general immunity. We ignore it at our peril.

How much vitamin D is enough? Start with 400 IUs a day for an adult, obtained through diet. If you are older, larger, darker, carry extra fat, have trouble digesting fats, are already D-deficient, have health issues involving the processes outlined above, or live in a dark closet you will need more.

The Endocrine Society recommends levels higher than the USDA. From their perspective a large, dark skinned, 67-year-old male carrying extra fat would optimally use about 800 to 1000 IUs daily. If he lives in sunlight deficient regions part of the year, go with the higher number.

Women need a little less. Children even less, and babies need baby amounts. There are good tables available on the internet if you really want to dial it in.

Or just run around naked in the sun for a half hour every day. Clothes are overrated anyway.

Larry Plesent is the founder of Vermont Soap and is a writer and natural products formulator residing in the green hills of Vermont. Read more from Larry's work at www.reactivebody.org. ♻

VT Composting Guide

Cont'd from p.21

How much space do you have? How much time do you have? How much energy do you have? How much do you care about producing good quality compost (versus finding a convenient way to keep food scraps out of the trash)? How will you use the compost you create? On a lawn or garden? For trees or shrubs?

Eight different methods of composting are briefly described along with a few pros and cons as well as a link to get detailed instructions on how to implement that method in your backyard. These are: the Pit, the Trench, the Trash Can, the Pallet Bin, the Tumbler, the Multi-Bin System, various Other Store-Bought systems, the NOT Composter Green Cone. That last one was unknown to this reviewer and seems like it might hold great promise to many people who might otherwise find composting much too challenging. The guide says, "Green cones are partially buried solar 'digesters.' They do not make compost; materials digest underground and fertilize the soil nearby. They are totally enclosed systems, so animals are less attracted to them. Unlike composters, Green Cones do not require management once installed."

Details are provided for the types of materials that go into a compost pile and what should not, how to handle meat and bone scraps, the management of compost, a step by step description of building a pile, examples of how to use the compost you make, the difference between hot or cold composting, what to do during the winter months, and finally, basic troubleshooting including tips on animal control – here's one: bears don't like the smell of ammonia so place a few soaked rags in cans around your pile!

The guide is available online from the Vermont Agency of Natural Resources webpage. Navigate to the Department of Environmental Conservation and follow to Solid Waste and Recycling topic where you will find a section on food scraps.

Michael J. Daley is a life-long renewable energy educator and advocate, except for a brief time in high school when he though nuclear power was cool. He lives in a tiny off-grid cabin in Westminster, VT with his wife, Jessie Haas. ♻

Energy Secretary Granholm: Heat Pumps

Cont'd from p. 25

produce no fumes or greenhouse gases. If the electricity source is renewable, they reduce our dependence on fuels of any sort. They can be driven by a household solar array with batteries. The fact that heat pumps can be powered by renewable energy and emit no greenhouse gases is also a good reason for the country to adopt them.

The Department of Energy (DOE) has been encouraging greater numbers of manufacturers to introduce their own models of cold climate heat pumps to increase their use in colder parts of the country. The DOE had said that Midea, Bosch, Daikin, and Johnson Controls had all introduced such models. Now, Carrier, Lennox International, Trane Technologies, and Rheem have joined them.

Secretary Granholm said, "People recognize that it reduces their energy bills, reduces their carbon pollution, and also it saves them a lot of money. But now, making sure we are making that technology available to colder climates, that is going to help the entire nation be able to do this."

She also said one thing we find especially noteworthy. It is, "This is basically a $23 trillion global market for clean energy products, and the United States now has become the irresistible place to locate that production." ♻

ULTRATECH LIGHTING – Cont'd from p.30

spectrum of their fixtures to meet very specific applications. For example, horses and other bovines only see in two colors; they are "dichromates." Horses are disturbed by the high glare and flicker of LEDs. There were no bulbs designed to match the specific visual acuity of horses, cows, sheep, and other bovines until Ultra-Tech™ developed its Equine-Bright™ lights that match the way horses see. At the same time, Equine-Bright™ includes colors to balance output for human vision; the best of both worlds

Another example is Snow-Bright™ lighting for illuminating ski slopes and other snow sports venues. These fixtures match the refractive and reflective properties of snow; a white and highly reflective crystal surface. Ski areas were experiencing problems with LEDs because of their disorienting flicker and high glare. Skiers were literally being blinded by the light. Snow-Bright™ fixtures can be safely viewed without blinding people or animals. Ice rinks discovered that LEDs shine bright spots over the ice that can obscure the fast-moving puck. Enter Rink-Bright™ that solves the problem and has added advantages of running cooler and longer, beyond 100,000 hours of continuous use.

The Frear Park rink in Troy, NY replaced thirty 1,000-watt metal halide fixtures with twenty-eight 300-watt Rink-Bright™ lamps and got better illumination at a fraction of the cost than if they had tried using LEDs. Rink-Bright™ is designed specifically to illuminate ice rinks with energy savings that were so substantial that National Grid rebated 70% of the re-lamping cost to Frear Rink operators.

One of the Ultra-Tech product lines is Office-Bright™. No surprise there. Another is Work-Bright™ for warehouses and factories. They have lights for cold storage facilities because needs for office workers and other workers are not the same. School-Bright™ fixtures can improve student concentration and address issues for special needs children with autism, ADD/ADHD, and other conditions.

Grow-Bright in action. (Ultra-Tech Lighting)

Most significant, Ultra-Tech™ is true to its sustainability goal. MIL is extremely efficient and can be customized to specialized situations. For example, marine environments must be protected against light pollution that can disturb breeding patterns of sea turtles. Ultra-Tech™ developed Port-Bright™ to address this issue. You may have experienced the disturbing effects of new LED street and highway lighting. Flicker can cause accidents. Glare can cause a hypnotic effect. Ultra-Tech™ has a unique "cobra-head" Street-Bright™ fixture that is more economical for municipalities, because it lasts so long and saves electricity. Street-Bright™ is a safer flicker-free, glare-free alternative to LEDs.

Tesla's genius is exemplified by the fact that magnetic induction can generate extraordinarily powerful full-spectrum ultraviolet (UV) wavelengths. Ultra-Tech™ developed an entire line of sanitizing and deodorizing units called Sterile-Bright®. Originally designed to address diseases and odors in animal facilities, the COVID pandemic inspired Sterile-Bright® models for human environments. Unlike other UV devices, Sterile-Bright® is so powerful that it can sanitize and deodorize a 20 feet by 20 feet by 9.5 feet space against COVID and even MRSA in under five minutes. Sterile-Bright® has become popular for use in nursing homes, hotels, and animal facilities like horse stables, pig farms, dairies, and poultry operations. Sterile-Bright® protects indoor grow houses against mold and bacteria. It can also deodorize garbage transfer stations, sewage treatment plants, and other odoriferous operations.

There are specialty product lines for artists and people interested in jewelry, Art-Bright™ and Gem-Bright™. Here again, it is clear why special lights are needed. To be seen properly, paintings must be properly lighted. But as they are exposed to ultraviolet light, they fade. Historically, this meant that paintings had to be placed where sunlight could give them its perfect color, but they had to be kept away from windows so they would not be damaged. Displaying paintings can be tricky, but Art-Bright™ lighting makes it relatively easy.

Grow-Bright™ lights are for greenhouses and other horticultural situations. A 300-watt light from Ultra-Tech can replace 1,000-watt metal halide or sodium lamps, eliminating the excessive heat. Hemp-Bright™ has a spectrum unique to marijuana cultivation. These grow lights are fine-tuned to promote photosynthesis, and the low energy consumption means major savings and a smaller carbon foot print. MILs are expected to last for 100,000 hours, which is well over eleven years of continuous lighting. When it comes to sustainable, energy efficient lighting, what's old has become new.

Ultra-Tech Lighting's web site is *www.ultratechlighting.com*. ♻

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