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EV MYTHS **BUSTED**

Martin Wahl

In this article we examine six common misconceptions about electric vehicles (EVs) the EPA deals with on their website (<https://bit.ly/EV-myths-1>):

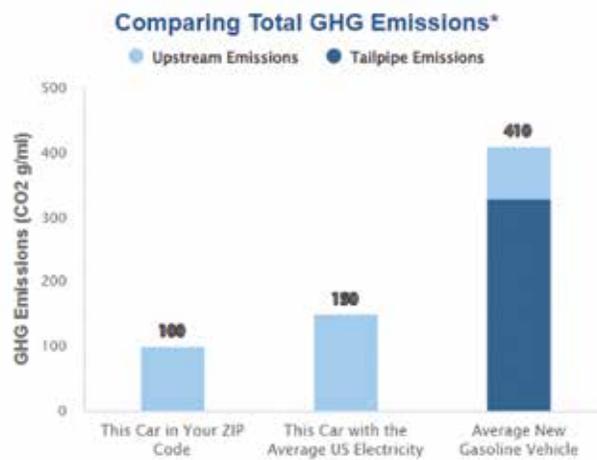
- Myth #1: Electric vehicles are worse for the climate than gasoline cars because of the power plant emissions.
- Myth #2: Electric vehicles don't have enough range to handle daily travel demands.
- Myth #3: Electric vehicles only come as sedans.
- Myth #4: There is nowhere to charge.
- Myth #5: Electric vehicles are worse for the climate than gasoline cars because of battery manufacturing.
- Myth #6: Electric vehicles are not as safe as comparable gasoline vehicles.

Myth #1- Power Plant Emissions Make EVs Worse for the Environment

Electric vehicles typically have a smaller carbon footprint than gasoline cars, even when accounting for the electricity used for charging.

Between 57% and 100% of the electric power generated in *Green Energy Times*' readership area (NY, VT, NH, and ME) is sourced from greenhouse gas (GHG)-free sources so their carbon footprint is relatively small. Non-GHG sources include hydro, wind, solar, and nuclear. Northern tier states also import power from Canada; most of it hydro-electric sourced. The percentage of power generated from non-GHG producing sources in March 2022 is shown below. Details are available at www.eia.gov/state:

Cont'd on p.7



100 g/ml

This Car's Total Emissions in your ZIP Code (Tailpipe + Upstream)

150 g/ml

This Car's Total Emissions with the Average US Electricity Mix

410 g/ml

Average New Gasoline Vehicle's Total Emissions

Figure 1: An average new gasoline vehicle emits almost FOUR TIMES as much GHG as a Mustang Mach-E in Montpelier.

The Era of Cheap American Gas is Over

Sam Evans-Brown

In the past two weeks, New Hampshire residents learned that most of our electricity bills will skyrocket in August. For Eversource's residential customers, the rate they pay kilowatt-hour will rise from 19 cents to more than 32 cents: 22 cents for the energy, and another 8 cents to deliver it. That represents about a 68 percent rise in electricity costs for those Eversource customers. With this rate, New Hampshire customers will nearly have the highest electricity rates in the United States: higher than Alaska, where most customers pay about 22 cents, and lower only than Hawaii.

Needless to say, if your state is paying nearly as much for energy than a string of isolated atolls thousands of miles from shore, something has to change.

We are now reaping what we have sown. Over the past 20 years, we have massively built out natural gas-fired power plants in New England, from 15 percent of generation in 2000 to 53 percent in 2021. Natural gas prices set our electricity prices, and pipeline gas in New England is currently two to three times more expensive than the same time last year.

This problem is not going away anytime soon. While it seems to us that



Alternative transportation when gas prices get too high. (Flickr/peggydavis66)

prices have gone through the stratosphere, gas is currently fetching ten times more in Europe. American producers are responding to this powerful price signal to send their product overseas. And with the European Union's newfound resolve to wean themselves off Russian gas, even more American gas will not be burned at home.

If you're hoping that American production will rise again, don't be so sure. From 2010 to 2018, the low price of gas in the US meant that the American fracking industry lost a cumulative \$181 billion dollars, which led the former CEO of the nation's largest gas producer to call the shale

Cont'd on p.20

Vermont Reaping the Benefits of Yesterday's Forward-Looking Energy Policies

Jonathan Dowds

New Hampshire households are about to get hit hard, really hard, by rate hikes that will increase electricity bills by an average of more than \$70 a month. These unprecedented rate hikes reflect surging natural gas prices and New Hampshire's ill-fated decision to tie its electricity prices to volatile fossil fuels. While New Hampshire's rate hikes are particularly dramatic, the state is far from alone – rates are up 8% nationally and 15% in Florida, Illinois, and New York. Fortunately, Vermont's forward-thinking energy policies – most notably our decisions to stick with a regulated utility model and invest in renewables – are protecting Vermonters from similar rate increases, at least in the short term.

As we plan for a future where more and more of our cars and home heating are electrified, it is helpful to look at why electric bills are going haywire. New Hampshire's rate increases reflect the price of natural gas which fuels more than half of the region's power generation. While Russia's unprovoked invasion of the Ukraine is the current and most dramatic event

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Hopefully we have not forgotten to mention anyone. It is your help that paves the way to a sustainable future.

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Our mission is to create Energy Awareness, Understanding and Independence – Socially Responsible Living.

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Green Energy Times would like to thank everyone who has submitted articles or helped in any way to make this all a reality. We want to also thank our advertisers & ask that you support them. Say that you saw them in *Green Energy Times*. Now let's all G.E.T. moving ahead towards a clean, renewable future – one where our children & grandchildren will be able to breathe & grow, live & love on this beautiful planet where we live.

Thank you for reading G.E.T. Please send your comments & suggestions to: info@greenenergytimes.org

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Kudos to the Green Energy Times Team Helping G.E.T. Save the Planet

G.E.T. staff

Over past issues, we have been looking at how the *Green Energy Times* team of workers and volunteers makes emissions reduction and energy savings a personal issue, doing their part to reduce pollution of all kinds and make our world a safer place where people can live healthy lives. Now, we come to the example set by Michael J. Daley and Jessie Haas.

Michael J. Daley and Jessie Haas, writers for G.E.T., live in a 450 square foot off-grid home that they built starting in 1984 in Westminster West, VT. "We were inspired by Thoreau and the Nearing's," Jessie says. "We wanted to write and knew we'd need a wide margin of time for that, so living cheaply was very important. We were also worried about nuclear power, global warming, and the environmental ugliness of mainstream consumerist society. We wanted to do our part to stop it."

The house started out at 12 x 16' and was made from local roughsawn hemlock and salvaged windows. Additions over the years included insulation (our first winter water froze in the jugs on the floor!), writing spaces, an 8-by-14 sun room made with salvaged windows, and a 5-by-12 split-level bedroom placed over a small wine cellar.

Michael, for many years an alternative energy educator, made the first solar panel using surplus cells, part of the fallout from the Reagan era devastation of the solar industry. Currently, the off-grid system consists of a single 100-watt panel and one lithium-iron battery, which replaced a lead-acid deep-cycle. Before getting the lithium-iron battery, the couple made fairly frequent use of a 1000 watt gasoline generator, the smallest Honda makes. Now it runs for one hour a month for maintenance.

"We use roughly 100 times less electricity than the average Vermont household," Michael says. "Efficiency technology and a conscious dedication to creating a small environmental footprint makes that possible. For example, we were early adopters of laptop computers for our writing work because they consume so much less power than a desktop model. Same story for compact fluorescents, then LED lighting. Revolutions, all of them. Technology really has its place in saving the world because the old stuff was built with a waste-blind design consciousness."



Michael Daley in front of the 450 square-foot off-grid house he and Jessie Haas have lived in for almost 40 years. Electricity comes from the single 100-watt panel. (Jessie Haas)

Refrigeration and cooking are propane-powered; heat is wood. Plumbing is all outdoors; indoor running water would have triggered a requirement to build a mound septic system which would have cost four times more than the house. Human waste is handled by a composting privy, saving countless thousands of gallons of pure water from being contaminated.

The house is 600 yards into the woods, with no driveway, so all building materials needed to be carried in, and all the construction was done with hand tools. "We were young!" Jessie says. These days an electric golf cart helps with the heavy lifting for about eight months of the year. "The key to succeeding

at this lifestyle is keeping the house very small and being comfortable with doing things half-assed. It has let us live here for 38 years burning only two cords of wood a year, having no mortgage, working part-time early on, and getting 48 books published between us."

Another very important factor was living next door to Jessie's parents' farm, which allowed tool sharing and occasional access to the comforts of civilization, including internet.

"In the first few years it was also our only access to telephone," Michael says. "Jessie had to get calls from her publisher at the farm. It was always amusing to explain this to city people." Eventually, the couple strung their own phone line through the half mile woods separating them from the farm and tapped in to the telephone link there. "Squirrels really loved to chew the cable and lightning found it a few times, so it was a constant maintenance chore," Michael adds. "We really love the cell phone revolution!"

Transportation is an issue right now, as the couple is enduring supply-chain problems preventing the repair of their beloved Ford C-Max plug-in hybrid, which was running at high speed when the power steering failed in January.

"Right now we are very engaged with regenerative approaches to solving global warming," Jessie says. "It's amazing to know that our small cottage garden, seen by practically no-one but ourselves, is a vital part of feeding pollinators and supporting biodiversity. It's so important that we all do everything we can, where we are, to enhance the living systems that we arose from and depend on." ☺

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Playing Defense on Energy Efficiency in the NH Legislature

In the last session, advocates were forced to counter efforts to stymie progress

Kelly Buchanan and Sam Evans-Brown

Energy policy

The 2022 legislative session started early when it comes to energy policy. In November 2021, after nearly a year of delay, state regulators issued an order that would have completely dismantled the state's energy-efficiency incentives. The order upended nearly a decade of policy and programmatic progress for the energy-efficiency programs: work stopped, trucks were grounded, and efficiency contractors were pitched into a world of uncertainty.

However, a broad coalition came together in the beginning of the 2022 legislative session to fast-track and pass a bill, House Bill 549, that salvages and attempts to future-proof the energy-efficiency programs. This was the theme in the 2022 session. Clean energy advocates managed to play defense to ensure existing policies remained in place, but struggled to gain support for new, innovative clean energy policies.

Net metering

Net metering, the ability to roll your electric meter backwards and sell electricity onto the grid, is the bedrock of the business model for small-scale renewable generation. House Republicans led efforts to reduce the net-metering credit through two bills: House Bill 1599 and House Bill 1629.

Both bills would have reduced the value of electricity sold back to the utility, which is already the lowest in New England. But there was little appetite for tinkering with the net-metering credit in the Senate. The senators agreed to wait for the results of a highly anticipated Value of Distributed Energy Resources study expected from the Public Utilities Commission no later than May 31 before making any drastic changes. To date, the study results have not been released, and they are now more than a month late. Stakeholders predict the eventual release of the study results will kick off a new process that will once again revisit how much to pay small renewable generators,

which is likely to be a long and drawn-out fight.

On a brighter note, Republican Senator Kevin Avard led the way on two progressive clean energy bills proposed this year.

Senate Bill 262, as originally drafted, would have allowed larger projects to net-meter, meaning the state's medium and large businesses could better control the cost of their energy. However, the bill was amended by the House to only include a study on the rising and uneven costs of interconnection of renewable energy resources in New Hampshire and fix a technicality that has prohibited some early municipal adopters of renewable energy from benefiting from newer, community-scale renewable projects.

Finally, several bills were proposed that aimed to unlock the potential of the new five-megawatt cap for municipally net-metered projects, which was passed last year. While the original proposal would have included universities and housing authorities in the new expanded net-metering program, that language was sidelined by the House of Representatives. The Senate revived a compromise version that will only allow the state government to benefit from the higher cap.

Renewable energy development

This session, the solar industry faced a challenging and premature effort to impose a requirement for solar panel take-back and recycling. HB 1459 would have required the Department of Environmental Services to establish a program, approve plans



Jimmy Emerson/Flickr

submitted by solar installers for a fee and ensure compliance with the program. Each unit sold in violation of the requirements would face up to a \$10,000 fine. After passing through the House, the

bill failed in the Senate after the NH Department of Environmental Services expressed opposition due to concerns about how to administer the program and whether it was warranted.

Two Senate bills passed this year to improve access to renewable energy. SB 321 enables a pilot program to expand distributed generation between one and five MW that could create a new business model for community-scale renewable energy projects. SB 270 creates a new low and moderate-income community solar program, which would create community solar projects and automatically assign income-qualified customers to receive the benefit.

As written, the bill will require the Department of Energy to develop a process to select eligible participants from the Electric Assistance Program, with help from New Hampshire utilities.

Electric vehicle legislation

Interest in electric vehicles (EV) is taking off in New Hampshire, but the General Court failed to move forward even the most simplistic EV legislation in 2022.

SB 417, a pilot program for electric school buses, and SB 447, establishing a fund for federal EV money at the NH Department of Transportation, both left their House committees without recommendation. When these bills went to the House floor,

they were tabled without an opportunity for further debate.

The 2022 session presented plentiful opportunities for playing defense, but few moments of real clean energy progress. As we look forward to 2023, we hope legislators and Granite Staters alike will step up to accelerate the clean energy transition.

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Kelly Buchanan is director of legislative and regulatory affairs for Clean Energy NH. Sam Evans-Brown is executive director of Clean Energy NH. ☺

2021 National Solar Jobs Census Released

Solar Jobs Up in 47 States, Increase 9% Nationwide in 2021

Solar energy jobs were up in 47 states and increased nine percent nationwide from 2020 to 2021 to a total of 255,037 solar workers, according to IREC's 2021 National Solar Jobs Census released today.

This job growth took place in a year of record solar installations driven by increased demand for renewable energy among residential customers, municipalities, businesses, and electric utilities.

Overall, the solar industry added 21,563 jobs in 2021, with more than two-thirds of these new jobs (14,350) at installation and project development firms.

"America's solar industry came back strong from the pandemic to expand the clean energy workforce across all regions of the country," said Larry Sherwood, President and CEO at IREC. "The future remains uncertain in light of the supply chain disruptions, trade issues, and stalled federal policy in the first part of 2022. There is potential for unprecedented job growth in the coming years if federal, state, and local leaders take action to expand clean energy use and address climate change."

Download the report at <https://bit.ly/Solar-jobs>. ☺

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Vermont's Summer Session Deep Dive on Climate Series

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As Vermont continues to work toward a notable reduction of our greenhouse gas emissions, we're going to need to make a big transition away from gas-guzzling cars to cleaner modes of transportation. The news is **the 2022 legislative session in Vermont closed with significant investments in sustainable transportation** that will help expand Vermonters' options for moving around and spending less on gas. Funding for electric vehicles (EV) incentives and charging infrastructure in particular saw major wins.

Vermont is now putting a priority on investments in vehicle electrification programs. It is important that the Scott Administration follows through to deploy these dollars now, rather than later as he proposed.

Below are the highlights of the progress made in Vermont on transportation electrification this year from the Transportation and Appropriations bills. Sufficient funds were made available for education, outreach, and translation services so that all Vermonters have a meaningful opportunity to benefit from them.

Electric Vehicle (EV) Incentives and Marketing

Combined, these incentives will help thousands of low- and moderate-income Vermonters purchase EVs:

1. Incentive Program for New Plug-in Electric Vehicles (PEVs). The legislature authorized \$12,000,000 for PEV purchase and lease incentives under the Incentive Program for New PEVs.

2. MileageSmart. The legislature authorized up to \$3,000,000 for purchase incentives under MileageSmart, which is the State's vehicle incentive program for used high-fuel-efficiency and electric vehicles.

3. Replace Your Ride. The legislature authorized \$3,000,000 for incentives under Replace Your Ride, which will be the State's program to incentivize Vermonters to remove older low-efficiency vehicles from operation and switch to modes of transportation that produce fewer greenhouse gas emissions. This program was originally created in the 2021 Transportation Bill and is expected to be launched in coming months.

4. Drive Electric Vermont (DEV). The legislature authorized up to \$2,000,000 to expand Vermont's public-private partnership with DEV to support the expansion of the PEV market. DEV is the lead resource for vehicle electrification expertise and marketing in Vermont.

5. eBike Incentives. The legislature authorized \$50,000 for incentives under a continuation of the eBike incentives, which will be the State's programs for providing incentives for purchasing electric bicycles. This program was originally created in the 2021 Transportation Bill and is expected to be launched in coming months.

EV Charging Infrastructure

Electric vehicle supply equipment (EVSE). In furtherance of the State's goal to increase the presence of EVSE in Vermont:

1. The legislature authorized up to \$6,250,000 to install level 3 chargers along the State highway network. This should get 100 or more fast chargers built along Vermont highways. For more on the difference between "level 3" (also known as "fast chargers" or "DC fast chargers") and "level 2" chargers to <https://bit.ly/Forbes-EV-charging-levels> or <https://bit.ly/Electric-charging-standards>.

2. The transportation bill also amends Vermont's goal to have a level 3 EVSE charging port available to the public within one driving mile, down from five miles, of every exit of the Interstate highways within the state and 25 driving miles, down from 50 miles, of another level 3 EVSE charging port available to the public along a state highway.

3. The legislature authorized up to \$10,000,000 to install EVSE at multi-unit dwellings, workplaces, and public venues and attractions, such as parks, state parks, access areas, downtowns, museums, and ski mountains, which should get over 1000 new level 2 chargers installed around the state. ..☺

USPS Plans for More Electric Mail Trucks



On July 20, 2022, the US Postal Service (USPS) announced that at least 40% of the 84,500 new vehicles it plans to purchase will be battery-electric. That's four times more electric mail trucks than USPS initially announced it would purchase.

This is a big win, but we must continue to keep the pressure on to make this new fleet a greener, cleaner fleet for the future. ♻️

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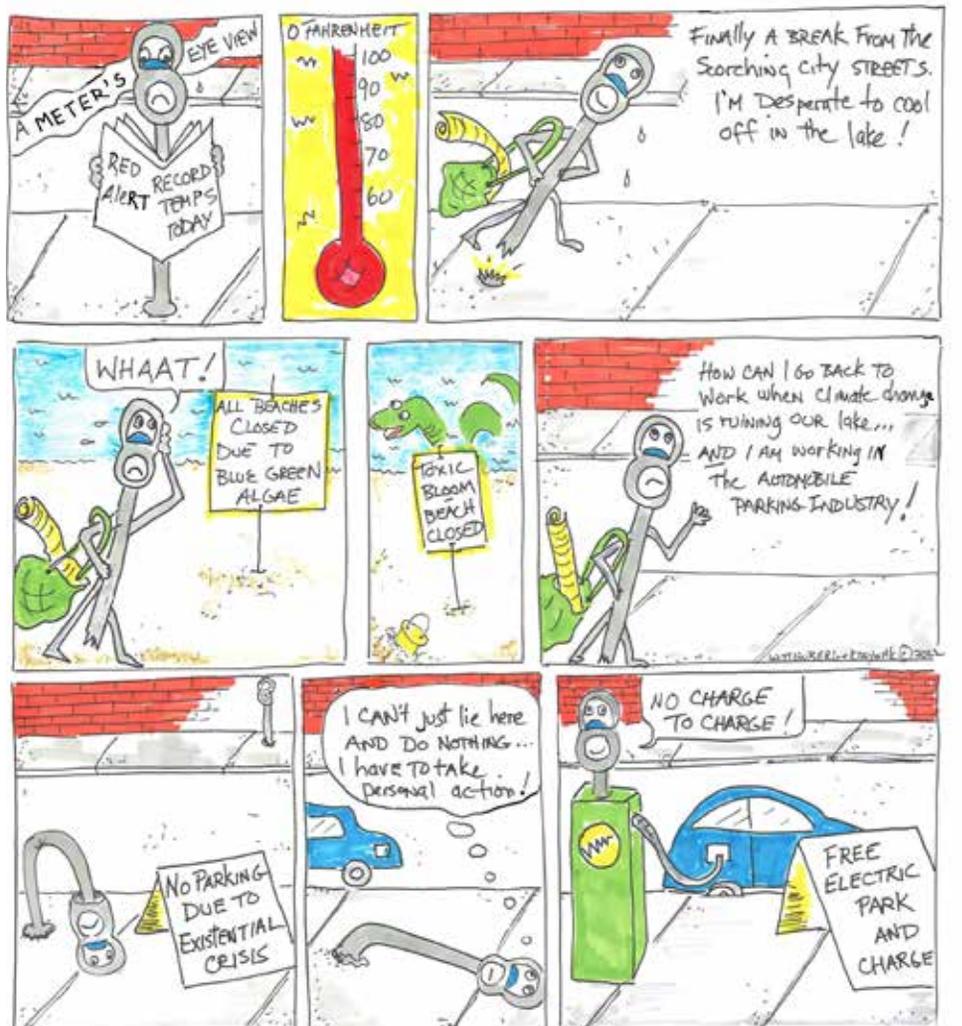
New E-Bike Rebate for Vermont Residents

Save up to \$400 on your new e-bike purchase!

The State of Vermont is offering a new rebate for eligible Vermonters that saves consumers up to \$400 on the purchase of a new e-bike. The rebate amount is based on claimed income.

More information can be found on the Consumer Attestation Form at https://bit.ly/VT_ebikeincentiveform.

The incentive can be stacked with the incentives provided by Green Mountain Power, Washington Electric, and other utility companies for a total savings of up to \$600. ♻️



Cartoon courtesy of Leah Wittenberg. See more of her work at leahwittenberg.com.

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G.E.T. Staff

G.E.T.: What is your title, role and how did you get started in this industry?

Shannon Garvey: I am the General Manager of Garvey Nissan in Clarendon, Vermont. Recently, my sister and I became owners with my father, so it is very much a family business! I got started in this industry by a great opportunity to work for Hyundai Capital in South Korea ten years ago. I immersed myself in the culture and brand then came home to work for my father's store in Queensbury, NY. I started as a title clerk and worked my way through most positions in the dealership until I was finally ready to manage a store.

When was your company started?

SG: Garvey Nissan was established in 2015, but my father has been in the automobile business since 1978 when he purchased his first store, so almost 45 years!

How many dealerships does your company own?

SG: Our business, Drive Garvey, owns three dealerships: Garvey Nissan in Clarendon, VT and Garvey Hyundai and Garvey Genesis of Queensbury, NY.

About how many customers do you serve per year?

SG: We serve thousands of customers between new and used car sales, auto part sales, and servicing all makes and models from New York to Vermont and



Shannon Garvey



in looking for an electric vehicle (EV). Year over year we see more customers inquiring about EV's to satisfy curiosity, learning and gaining knowledge about how the change to electric would fit their lifestyle, furthermore, with the increasing range and capabilities for charging, more are feeling confident with the switch from gas to electric. Let's not forget about the incentives, too, making the switch financially more comfortable. The market in the past five years has dramatically changed for EV's. In the beginning of 2020, we went from always having a few EV's in stock



the surrounding states. We have seen an increase of out of state customers in the past year due to never selling over MSRP and our award-winning customer satisfaction ratings.

How long have you been selling electric vehicles?

SG: We became certified to sell electric vehicles in 2015, so seven years.

What percentage of customers come in looking for an electric vehicle? How has this changed over the past five years?

SG: About 10% of our customers come

to now selling EV's sight-unseen in our pipeline. We are now taking reservations for the long awaited Nissan ARIYA which hits the lots this fall and comes with an AWD option, which will be a great for those with that need here in Vermont.

How long have you been a member of the EEN? Are there customer benefits to you being an EEN member?

SG: Garvey Nissan partnered with Efficiency Vermont this year! There have been many benefits to this partnership, but the most important reason is to show our community and customers our commitment and support.

What are some questions you recommend customers ask when looking to purchase an electric vehicle?

SG: Ask about incentives and understand what you qualify for. There are even incentives for pre-owned EV's. Understanding your own driving habits and how that will effect your battery life, where and how far you travel, charging capabilities and charging locations. We encourage customers to ask about maintaining the EV as well and understanding the cost savings. We are here to guide you through that process.

Anything else you'd like to tell us about being an electric vehicle dealer?

SG: It has been an exciting journey to see the demand increase over the last few years and are proud to be able to support those who are energy conscious. We have welcomed many happy new customers to the Nissan and Hyundai brand who previously never considered it. With many new EV models coming to our lots soon, we are excited to continue to support this community. Also, with the support of EEN and Green Mountain Power, we are happy to announce we will have a new fast charging station installed this fall by the entrance of Garvey Nissan! ♻️



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Financially: Keep a Gas Car or Buy a Plug-In Car?

Wayne Michaud

Many factors come into play when evaluating the power source of the personal vehicle you choose to drive. Hold on to your internal combustion engine (ICE) vehicle that uses gasoline? Or make the big switch to a plug-in vehicle: either a plug-in hybrid (PHEV) which is an extended range electric that includes a small gas engine, or an all-electric (EV)?

The standout points to be weighed are the myriad financial and environmental impacts of such a decision. In a two-part analysis, we will cover these impacts: financial in this issue, and environmental in the next issue.

Factors to consider when driving a gas vehicle versus a plug-in are how much it costs to fuel and maintain. So, let's do a few side-by-side comparisons made possible by fueleconomy.gov.

2022 Ford Mustang Mach-E RWD¹ (EV) vs. 2022 Ford Mustang Mach 1 RWD (ICE)

The Mach-E lists at \$44,000, but not factored in is a \$7,500 federal tax credit; also, New England states and New York have governmental and utility cash incentives that can bring purchase cost down by several thousand dollars. This Mustang is rated at 100 MPGe² with a range of 247 miles. The Mach 1 is \$55,000 and is rated at 20 MPG combined city/highway. In this comparison, with a gallon of gas costing \$4.65 and driving 10,000 miles a year, a whopping \$9,250 in fuel costs will be saved over five years with the Mach-E. But there's more. According to a Consumer Reports analysis, as a result of having many fewer moving parts, no oil changes, and less brake wear due to regenerative braking, PHEVs and EVs have one-half the maintenance and repair costs of an ICE vehicle! Performance-wise, this base Mach-E zips to 60 MPH in a tailpipe-emissions-free 5.2 seconds³. The more expensive and CO₂ emitting Mach 1 is substantially quicker. Though this economical comparison is a slam-dunk for the Mach-E, range on road trips and in cold temperatures can be a concern, though with available options it can achieve up to 303 miles of range. One other temporary but important factor: according to Ford, due to high demand and limited inventory, the new Mach-E is not available for order.

2019 Subaru Crosstrek PHEV vs 2019 Toyota Rav4 (ICE)

These 2.0-liter, 4 cylinder, AWD vehicles answer the call in northern New England and North Country. With these used vehicles at, say, 75,000 miles traveled, the Crosstrek's estimated value is \$20,000, and the Rav4 at \$24,000. The Crosstrek is rated at 86 MPGe with 17 miles on electric power (some PHEVs offer electric-only ranges to 60 miles), then at 35 MPG combined city/highway in gasoline mode. The Rav4 gets 30 MPG overall on gasoline. Their acceleration is similar. While the fuel cost savings are not as apparent as with the Ford Mustang comparison, the Crosstrek is the fuel economy winner here, and can qualify for used hybrid/PHEV/ EV cash incentives offered in Vt, NH and ME. PHEVs answer concerns on range anxiety, especially with the many used EVs today that have a limited range of 75 to 110 miles. In effect, they are a bridge to vehicles that will offer a standard range of 400 or more miles on a charge, anticipated by 2030.

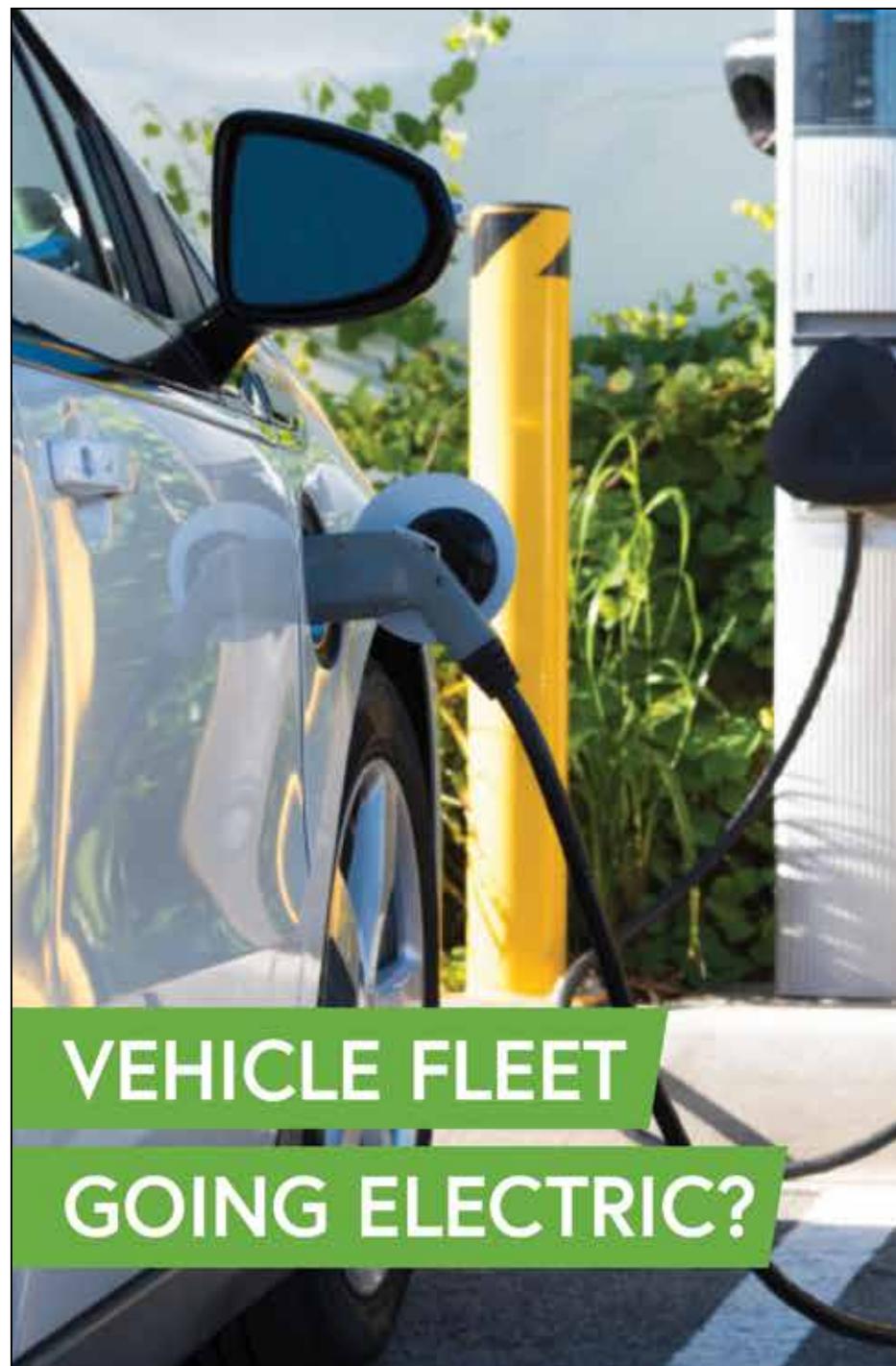
2014 Nissan LEAF S EV vs. 2014 Honda Civic LX (ICE)

While these are both classified as economy vehicles, the overall costs from used purchase price through operation are starkly different. The LEAF, equipped with the optional 6.6-kW onboard fast charger, has an estimated value of \$7,500 at 75,000 miles traveled. The 1.8-liter, 4-cylinder Civic's value is \$12,000 with 100,000⁴ miles on the odometer. The LEAF is rated at 108 MPGe with a range of 84 miles; the Civic's combined city/highway MPG is 34. With gas costing \$4.65, and driving 10,000 miles a year, the LEAF will save \$4,750 in fuel costs over five years. Plus, it offers significant cost savings in used-EV state incentives, and it has one-half the maintenance costs. The Civic edges out the LEAF in acceleration. While the LEAF is a decided winner in purchase and operating costs, a tradeoff is its limited range, which is compounded in cold temperatures. While the fast charge system can charge it up in under five hours, the LEAF is limited to relatively short commutes.

Other Economic Considerations

Charging: Especially at home and even before the 2022 surge in gas prices, charging has been one-half to one-sixth the cost of gassing up. However, public level 3 DC fast charging can be as much as three-quarters of the cost of gasoline. About five to ten

Cont'd on p.35



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EV MYTHS



Cont'd from p.1

- Maine – 75%
- New Hampshire – 83%
- New York – 57%
- Vermont – 100%

The EPA's GHG Emissions Calculator (www.fueleconomy.gov) shows total GHG emissions per mile traveled, including "up-stream" emission from the production and distribution of gasoline and electricity, for the typical gasoline powered car and the many EVs available today.

See figure 1 on p.1 for the all-wheel drive 2022 Mustang Mach-E in Central Vermont.

Myth #2 - EVs Don't Have Enough Range

Fifty electric vehicle models priced under \$60,000 (including destination charge) have estimated ranges between 210 and 358 miles. Note that these EVs, except those from Tesla and General Motors, qualify for a tax credit of up to \$7,500 against income tax owed.

Visit www.insideevs.com to see a variety of vehicle prices and ranges. Disclaimer: *InsideEVs* is a commercial site that aggregates manufacturer and EPA data and provides links to EV sellers.

The EPA website provides a variety of vehicle performance comparison tools: www.fueleconomy.gov

Visit *Green Energy Times* website (www.greenenergytimes.org) to see a list of EV models priced below \$60,000, sorted by price with ranges.

Myth #3 - EVs Only Come as Sedans

Today there are many SUV/crossover EVs available with prices ranging from \$34,000 to \$133,000. Visit G.E.T.'s website (www.greenenergytimes.org) for a list showing vehicle type, price, range, and drive configuration.

If you add plug-in hybrids to the mix, there are plenty more to choose from.

Of course, the first Tesla was an electrified sports car, a modified Lotus Elise, and Tesla promises a new version (for \$200,000) next year; and Polestar's 02 Roadster concept car comes with a cinematic drone to document your driving experience - just don't deploy the drone before entering a tunnel.

Myth #4 – There is Nowhere to Charge

See screenshot (See the chart on *GET's* website) from the U.S. Department of Energy website's Electric Vehicle Charging Station interactive map showing charging stations in the *Green Energy Times* readership area:

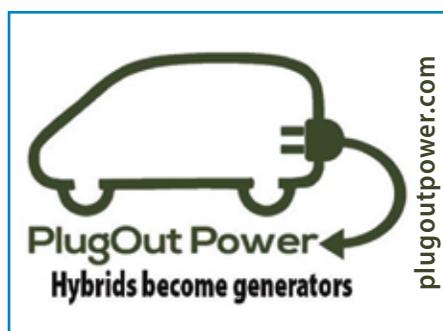
Visit that site (afdc.energy.gov/fuels/electricity_locations.html) to zoom in on your area. Also, try PlugShare's website (www.plugshare.com) to see facility details on their interactive map.

While most of the East Coast in general is well-covered, there are some areas in the Northeast that need more public charging stations.

Generally urban areas and their suburbs are well-supplied.

Myth #5: EVs are Worse for the Environment Than Gas Cars Because of Battery Manufacturing

While some studies show that making a typical EV can create more carbon



pollution than making a gasoline car due to the additional energy required to manufacture batteries, over the lifetime of the vehicle total greenhouse gas (GHG) emissions associated with manufacturing, charging, and driving an EV are typically lower than those associated with a gasoline car. That's because EVs have zero tailpipe emissions and are responsible for significantly fewer GHG emissions during many years of operation.

This is especially true for residents of ME, NH, NY & VT where electricity is from 57% to 100% GHG-free sources (see Busted Myth #1, above)

An exhaustive study by Ford and the University of Michigan further assessed the differences between sedan, SUV and pickup truck vehicle types also differentiating between Internal Combustion (ICE) Hybrid Electric (HEV) and Battery Electric (BEV) powertrain types. Visit *G.E.T.'s* website to get the link to the study.

Myth, # 6: EVs Are Not as Safe as Gas-Engine Cars

While Teslas and other electric vehicles catching fire do make the headlines, this may be primarily due to their novelty.

A recent *Forbes* article (link provided on *G.E.T.'s* website) summarized the points about fire danger succinctly:

- Gas-engine and plug-in hybrid cars are more likely to catch fire than EVs
- EV fires are, however, more difficult to manage and extinguish
- Crash tests reveal that EVs are at least as safe as others. Two EVs earned IIHS safety awards.
- Also, an updated analysis of insurance data shows injury claims are substantially less frequent for EVs than gas-engine cars.

Hopefully, these myths have been laid to rest. Because there is such a wide variety of electric and plug-in hybrid vehicles to choose from, in both the new and used car markets, readers are encouraged to research models they are interested in to assess their suitability, reliability, and availability. Right now, thanks to Covid and the associated chip shortage, it is a vehicle seller's market, so you may want to put off a purchase until supply rebounds. It is not too early, however, to start researching the best alternatives available to you.

Source links available with the posting of this article at greenenergytimes.org.

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

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Watts	Qty Available	Price per Panel
365	500	\$160.00

Q CELL 475W (USED)		
Min order: 1 pallet Location: Northeast Price per watt: \$0.38/W		Model Description: Q CELL Q PEAK DUO XL-G10.3
Watts	Qty Available	Price per Panel
475	1650	\$160.50

Suntech 370W		
Min order: 1 pallet Location: Northeast Price per watt: \$0.48/W		Model Description: STP37
Watts	Qty Available	Price per Panel
370	640	\$124.20

Suntech 270W Solar Panels		
Min order: 1 pallet Location: Northeast Price per watt: \$0.35/W		Model Description: STP270-24/Vd
Watts	Qty Available	Price per Panel
270	2150	\$94.50

Suntech 210W (Used)					
					Model Description: STP210-18/Ub-1
Watts	Condition	Qty Available	Pallet Price	Complete Lot	Panel Price
210	Used	1050	\$0.28/W	\$0.28/W	\$58.80

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SolarFest Returns to Center Stage in Brandon, VT



For over 25 years SolarFest has been the best summer festival in Vermont with the innovative idea of 'energy education through the arts.' Now they are building a permanent, year-round home in Brandon, Vermont to celebrate the wide-ranging solutions to climate change and its impact on our future. (Images courtesy of Mike Bailey)

Mike Bailey

SolarFest began with an innovative idea to bring people together with live music and fun in the beauty and warmth of Vermont as a way to celebrate the power and possibilities of solar energy and more.

Since 1995, these summer gatherings have inspired visitors from across North America with a unique blend of music, art, and education at a relaxed family-friendly festival. The SolarFest community is known for the most interesting conversations, bringing together outstanding artists, speakers, and practitioners to share their passions, the latest ideas, and real-world solutions to help shape a better world for us all.

Following two years of convening pandemic-driven virtual festivals, some generous patrons came together to

underwrite obtaining a suitable property for a permanent SolarFest home. With the diligence of their volunteer search committee, and the enthusiastic support of the Brandon Energy Committee and Selectboard, SolarFest moved fast in identifying the rolling fields, classic barns, and magnificent vistas of the Taconic and Green Mountains on the old Steinberg Farm as the perfect site to put down roots.

"Due to the commitment and generosity of the remarkable people who have been part of SolarFest, we're able to begin a new phase of sharing arts, ideas, and partnerships that can help create a strong and sustainable future," said Bill Laberge, President of SolarFest.

Brandon already has a vibrant music and arts scene, where the musicians,

artists, songwriters, and theater performers of SolarFest will fit right in. Centrally located and accessible, the home of the original Davenport electric motor is the ideal location for year-round demonstrations of renewable energy, green buildings, electric transportation, and regenerative agriculture. Plus, they have plans to return to providing training and mentoring for the next generation of clean energy professionals.

With a New Permanent Home, Now It's Time for a Party!

On Saturday, September 10th SolarFest will unveil its new home with an all-day festival featuring outstanding Vermont musicians, captivating displays and workshops, and a wide array of fun, exciting activities for the whole family. This homecoming also features delicious local food and beverages in a comfortable new food court, interesting vendor displays, and walking tours of the over 50-acre site.

The celebration starts at 11:00 am and runs through 10:00 pm, with live music starting at noon. Performers include an eclectic mix of original folk, rock, bluegrass, and jazz music, featuring the Krishna Guthrie Band, Luminous Crush, award-winning singer songwriters in-the-round, as well as the return of the SolarFest House Band, just to name a few. Even the solar-powered stage is both historic and sustainable, a donation by Ray Massucco from its previous use at the Roots-on-the-River Festival in Bellows Falls.

The legacy of SolarFest in making family fun affordable continues in 2022, with a return to the decade-old price of

only \$15 for early bird admission and kids under 12 admitted free with an adult. Complete details about the new SolarFest home in Brandon and tickets for the September 10th homecoming celebration are available at www.SolarFest.org.

Mike Bailey is a sustainable energy consultant and trustee of SolarFest.org. 



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MEET YOUR SOLAR INSTALLERS

In the February 2022 issue of *Green Energy Times*, we ran a center feature called “Green Energy Times Solar Installers,” providing information supplied by installers in our region. Please visit “GET’s Guide to Solar Installer’s” at www.bit.ly/GET-solar-installers. The series is about each of the the individual companies that took part in our survey, providing readers with more information about each of them. These articles will continue throughout this year. (Any solar installer not on our list who wants to be on it should contact us at info@greenenergytimes.org.)

Here we continue our “Meet Your Solar Installer” series, from A to Z, with Granite State Solar (Bow, New Hampshire).

GRANITE STATE SOLAR, BOW, NEW HAMPSHIRE

George Harvey

There have been a number of stories in *Green Energy Times* about Granite State Solar (GSS). In June of 2014 we ran an article “Solar Is Inexpensive” (bit.ly/GSS-Message). It began with a quote from Alan Gauntt, the founder of the company: “If you can afford your electric bill, you CAN afford to go solar.” For those who don’t know, the price of solar power has gone down since then, even as the cost of electricity has risen.

That was not the first article we had about GSS, and there have been several since it came out. A number of them show how much people appreciate the company. “Bradford Soccer Field Named after Granite State Solar” appeared in 2018 (bit.ly/GSS-field). That article is about a solar installer that had a playing field named after it by a school, showing appreciation for the work it had done.

We asked Julia Westbrook, the marketing manager at GSS, what makes the company stand out. She told us that the thing she hears comments about the most is the company’s customer service.

GSS is divided into teams. Potential customers initially meet with a GSS solar advisor. The job of solar advisors is educational. It makes certain that customers are fully informed about everything, so they can make the best decisions. Customer feedback is important. One thing GSS likes to hear is “Granite State Solar answered all our questions.”

When the decision is made to go ahead with an installation, a second team does that work. GSS likes to know that its installation workers are professional, courteous, and thorough. Westbrook told us one piece of feedback she has heard many times is, “The crew is really professional, and they leave the site cleaned up.”

There is another team that takes care



Rooftop solar and a ground-mounted solar system by Granite State Solar. (Courtesy images)

of service. Like the first two, it is made up of people who respect and value the customers. And as with those two, customer feedback is important.

Westbrook made one comment that summarized all of this. She said, “At the end of the day, the thing that makes Granite State Solar great is our people.”

She also made some points that may be very much worth thinking about. After saying, “Demand for solar in New Hampshire is huge,” she went on to explain further. “One great thing about solar is that it crosses the political divide.” Some people want to have a low carbon footprint and be environmentally friendly, and others want the independence and security that solar power offers. That divide is not all that big, because some people want both.

Part of solar power in New Hampshire is driven by the fact that people like to have a say in where their electricity comes from. When you electrify things with solar power, that gives you so much more control

over the prices you pay. And people in NH, regardless of their political leanings, like to be independent. Solar makes sense to just about anyone who really looks at it.

GSS installs batteries for customers who want backup power. It does not, however, do off-grid installations. It explains the reasons for this in a blog post at its website, “Off Grid vs Grid Tied Solar: What to Know” (bit.ly/GSS-off-grid). One issue here is that off-grid solar installations really require a different approach to living, and while many people are prepared for that, many are not. Again, a goal of the company is to make certain that people are well informed.

One thing that GSS tends to do differently is to use Enphase micro-inverters instead of a string inverter for a system. There are good reasons for this. While it is true that micro-inverters cost more, including them in a system has some important implications. One is that when micro-inverters are used, the entire array does not stop producing electricity, just

because a small part of it is in shade. This improved production can offset the slightly higher up-front cost so customers come out ahead in the long run. Another reason is that service is often much easier if anything goes wrong in the array.

As for other equipment, the solar panels GSS installs are from Hanwha Q Cells, Canadian Solar, and REC. For customers who want batteries, GSS supplies Tesla Powerwalls.

GSS can help customers with unsecured, low fixed-rate financing for up to 12 years for the systems they install. The rate is currently 3.99%. Financing can be done through VSECU, which may surprise some people who think of that as a Vermont institution, but GSS can do this by partnering with NESEA.

Attention to customers pays off, and this shows in some ways that are sometimes newsworthy. Granite State Solar has won awards for its efforts. This year, it won the NH Business Review’s 2022 Best of Business award as the state’s Best Solar Energy Company.

Granite State Solar’s website is granites-tatesolar.com. ♻️



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- CHECK OUT PARADISE PARK RESORT CAMPGROUND IN OLD ORCHARD BEACH -

Green Energy Times Staff

In 2018, Michael Holley, a partner in the Paradise Park Resort Campground and member of the Chamber of Commerce of Old Orchard Beach, Maine, contacted ReVision Energy about converting the Chamber of Commerce building to achieve zero-carbon emissions. By May of 2019, that job was actually done. The building was operating on heat pumps, both for heating and cooling and for hot water, and it was powered by a solar array on its roof.

The solar array turned out to be very successful. It supplies 105% of the electricity needed for the building, which is heated electrically. Holley emphasized this, saying, "So I'm proud to say that through our efforts, the Old Orchard Beach Chamber of Commerce is 100% carbon-neutral."

Holley has gone further, however, applying the experience to the Paradise Park Resort. This is not a trivial operation. He told us, "We're a full-service RV resort, including RV sites, ten sites and rental units featuring heated pools and hot tubs. ... It's a 45-acre facility here in Old Orchard. We have 240 total campsites. Sixty of them are seasonal campers. Their units stay here year-round. We have fifteen rental units, cabins and RV park model type rentals, and we have approximately 5010 sites."

Work started, and proceeded by increments. He started with 99 panels



Paradise Park Resort is a 45-acre facility with a 99-panel rooftop array and a 600-panel ground-mount array which provides 80% of the resort's electrical needs. (Courtesy photos)

installed on the roof of a shop, taking that facility close to 100% carbon-neutral, using the energy from its solar array and wood pellets. That combination provided for hot water to heat a pool and the two hot tubs. Holley made it



clear that one aspect of this that he is proud of is the support it gives to local forestry through its use of wood pellets.

A couple of years went by, and the work went on. Holley and others in his organization started looking into the possibility of a large expansion of their solar energy system. They determined that it would make sense

to have a ground-mounted array, and they started the process of getting that installation under way. "We're proud to say that in December of 2021, our ground mounted solar array went online, [with] 600 panels there."

This was a big step, and it paid off. Now, even with all its power needs, the Paradise Park Resort gets 80% of its electricity supplied from its own renewable energy sources. Holley said there are "no-guilt" pleasures to be had at the resort, because, in his words, "You can come spend a week at Paradise Park, enjoy heated pools and hot tubs and air-conditioned rental accommodations, and have ...

virtually no carbon footprint."

One of the great things that Holley points out about all of this is that the environmental benefits of Paradise Park's change to renewable energy is bringing the business economic benefits, producing good economic value.

But the benefits of low pollution and low carbon emissions go rather far beyond that. And they do this in ways that the people who use the facility can see and enjoy. "You can go fishing; you can watch turtles. We have a heron that comes fishing," Holley said. "There's a plethora of wildlife. So, I think it's a great example [showing that] humanity and nature can coexist and have paradise together."

Paradise Park Resort and campground is in Old Orchard Beach, Maine. Its website is paradiseparkresort.com. 



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Fortress Power Presents Their New Flex Tower

George Harvey

Fortress Power (FP) is a company that makes batteries with some fairly important advantages. It has been described in *Green Energy Times* in a couple of articles already, as we have looked into questions of mobile energy systems and battery backup for homes with solar systems. An article on the latter was "Working Together: Fortress Battery and Green Mountain Solar" (<https://bit.ly/GET-FP-GMS>). That article was of particular interest for the present one, because it discussed FP's eFlex 5.4 kilowatt-hour (kWh) battery.

Now, building on its success with the eFlex 5.4 lithium iron phosphate (LFP) batteries, FP has introduced a new product, the FlexTower All-in-One Energy Storage System (FlexTower). To understand this, we should do a quick review the eFlex 5.4 battery. It has a capacity of 5.4 kWh, weighs 108 pounds, has an efficiency of over 98%, and a discharge rate under 1% per month. It is far safer than old-fashioned lithium-ion batteries, has a 10-year warranty, and is rated for 8,000 cycles.

The FlexTower builds on the eFlex 5.4 battery by providing an enclosure for up to four batteries along the charge controller, an LCD control panel, and a remote monitoring app, so, for example, the user can tell what the state of charge is at all times. These are integrated in one DuraRack unit that also has space for an inverter, which the customer can choose from a respectably sized list. A 200-amp pass-through eliminates a backup panel requirement. Basically, that means it can include all the major equipment needed for an average household or commercial solar photovoltaic system but the panels themselves. (FP also has a larger product



for even larger systems.)

It supports operation off-grid and for back-up power, and it has an app for remote monitoring. But it goes far beyond those. It can be used for time-of-use and demand response applications. It supports peak shaving, and can function as part of a virtual power plant.

For household and commercial applications, planning for a FlexTower should be really simple. It can be installed in all sorts of places. Since there is no danger of gas or fire, indoor installations are as convenient as we might hope for. But the FlexTower is also rated for outdoor installations. Its normal operating temperature is 32°F to 114°F (0°C to 45°C), but it can have internal heating with modest power requirements. It can withstand any extreme temperatures that might be seen

in most parts of the Northeast because it has a thermostat and optional temperature controls to keep everything within its very wide operating range. We might note that for off-grid applications, the extra energy used by a heater should be considered before deciding to install the unit outdoors.

The FlexTower can be purchased with or without an inverter. The inverter can come from any of several companies, and a list of inverters is available at the FP website, fortresspower.com. The list has a wide variety of products to choose from, made by nine companies, Magnum, Midnite Solar, Morning Star, Outback, Schneider, SMA, Sol-Ark, Studer, and Victron.

We contacted Zach Reagan at Sol-Ark about his company's experience with FP's batteries. He told us, "Sol-Ark inverters actually have extra levels of communications and certifications with some batteries that have higher quality Battery Management Systems. Fortress is a great example of this type. The Sol-Ark hybrid inverters have settings for different batteries, and one of the battery companies we have the highest level of communication with is Fortress." He also stressed the fact that Sol-Ark and FP know each other's products. He said, "If you're on the phone with us about an inverter question, and you also have a question about the Fortress battery setup, odds are that we will be able to answer that question without you having to hang up and spend

any extra time on the phone by calling another company for that same question." It seems that we live in a time of increased communications, both for equipment, and for people.

The FlexTower is a relatively new product. But Fortress Power batteries are well known. One of the solar installers we know who has had a fair amount of experience with the equipment is John Blittersdorf. He uses Fortress Power LFP batteries for his own home and has installed them elsewhere. In one case, two systems that were very near each other were brought down by a single lightning strike, and this led to his having some experience dealing with FP's customer service department and repairing the units in the field. "Fortress Power is a good company," he told us, "And the owners seem eager to help." He also noted that customer service is really good, the equipment is well made, and it is easy to repair."

Fortress Power's website is fortresspower.com. ♻️





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Zinc8 Decouples the Linkage Between Energy and Power

George Harvey

There are many kinds of electric batteries. Given the needs for energy storage that exist today and will predictably come up in the future, it should not be at all surprising that many battery designs are being developed. Zinc8, based in Vancouver, British Columbia, has a unique approach to the problem, and we would do well to understand it.

Electricity can be generated when the metal zinc is oxidized. Batteries that use this have been around for a long time. The chemistry is commonly used for the button batteries that power hearing aids. It is usually used as a primary zinc-air battery, meaning that it cannot be recharged, but secondary battery chemistry, for rechargeable batteries, has been around for a while, though not widely used.

Now, we might do well to understand a different kind of battery, the flow battery. Most flow batteries have electrolytes that are stored in tanks and flow past each other in a vessel, usually separated by a membrane. Flow batteries have a lot of advantages, not the least of which is that they can be configured for a given



Zinc8 engineer working in the company's research facility in Vancouver, BC. (Courtesy images: Zinc8)

system. If more energy is needed over a longer period of time, larger tanks can be used. If more power is needed, a larger reactor unit can be used with more membrane area. Flow batteries can be designed to be easily rechargeable and offer promise for grid energy storage.

What Zinc8 has done is to combine these two ideas in a quite novel way, producing what it calls a "Zinc-Air Energy Storage System." This is a bit like a flow

battery, in its way, and it is certainly a zinc-air battery. But that combination is the very surprising thing that the people at Zinc8 have figured out.

One thing to understand is that the zinc in Zinc8's battery is in the form of particles about the size of particles of fine sand. In that form, they can be moved about in a fluid, which in this case is a solution of potassium hydroxide. When electricity is needed, zinc particles are gradually moved into a chamber where they can react with atmospheric oxygen, and this reaction produces electricity. It also produces zinc oxide (technically zincate), which is moved to a tank for storage.

When the demand for electricity drops and it is possible to recharge the battery, the zinc oxide is given a charge that causes it to give up its oxygen. This returns the particles to their original state, as tiny grains of zinc metal, and it is moved back to the zinc storage container.

There are certain things about this that are really beautiful. One thing is that zinc is a common element. It is easily available in nature. Neither the metal nor its oxide

is particularly toxic to human beings, though the metal is toxic to some lower life forms. In fact, because zinc, as an element, is a requirement for good health, zinc oxide may be added to breakfast cereal. (Please note that high doses of zinc, such as would result from swallowing the metal, are toxic. Also, bringing zinc to high temperatures, which results from trying to weld galvanized iron or trying to use the galvanized pipe on wood stoves, can cause severe health issues. These are not issues with zinc-air batteries, however.)

Zinc8 batteries also have some special characteristics. Zinc8 claims that they do not lose capacity with

Cont'd on p.14

Community Solar:

NEW HAMPSHIRE'S CENTER HARBOR REGION

A Partnership of Lakes Region Conservation Trust Partners with NH Solar Shares

Sandra Jones

Lakes Region Conservation Trust (LRCT) has announced their plans to partner with NH Solar Shares to bring a small community solar PV project to New Hampshire's Center Harbor region that will provide solar bill credits to families in need of assistance with their electric bill. LRCT will host the project in the field behind their office on Route 25B in Centre Harbor. It will consist of approximately 120 panels totaling a 40kW ground mounted solar array.

NH Solar Shares, a program of the Plymouth Area Renewable Energy Initiative (PAREI), set out with the mission to "Share the Sun with Neighbors" back in 2018 when they built their inaugural project on donated space in front of the Common Man Inn in Plymouth. Their second project is located in Warren, NH on donated roof space at the Appleknockers General Store.

"We are delighted to partner with LRCT to build our third project," said Caryn Shield the NH Solar Shares Program Coordinator. "This project will produce enough solar to benefit 12 families (that rotate every two years) from the towns of Center Harbor, Moultonborough, Holderness or Sandwich." In order to participate, families or individuals need an electricity account with the NH Electric Cooperative and be interested in learning about solar energy and home energy savings. Funds to build the arrays are raised through in-kind services, sponsorships, grants and charitable donations. NH Electric Coop-



The field of trunk sprouts will be the next site for a NH Solar Shares community solar project. Space has been donated by the Lakes Region Conservation Trust located on Route 25B in Center Harbor. (Peter Adams, EVP Marketing and Media, Campton, NH)

erative is an on-going partner with NH Solar Shares.

"We are excited to partner with Solar Shares to bring more clean energy on to the grid that will benefit local families. And we are fully behind the project goal to design an environmentally-friendly solar field with minimal impact during the construction phase where the habitat is improved with pollinator plants and low blueberry bushes," said LRCT President Don Berry.

"NH Solar Shares volunteers are teaming up with volunteers from LRCT, the Center Harbor Energy Committee and Conservation Commission and New England Commercial Solar Services to develop a model project that integrates solar energy into the landscape that compliments the land use needs for this particular location," said Sandra Jones, PAREI Director. "If this project sounds of interest to anyone in the community, I hope they'll get in touch with us."

If you are interested in volunteering on the project's committee, applying to

become a participant or would like to make a donation to fund the NH Solar Shares – Center Harbor solar array, please visit nhsolarshares.org, email volunteer@plymouthenergy.org or call the PAREI office at 603-536-5030. NH Solar Shares is a wholly owned subsidiary of the Plymouth Area Renewable Energy Initiative, a 501C-3 not-for-profit membership organization.

Sandra Jones is the Director of the Plymouth Area Renewable Energy Initiative (PAREI). She can be contacted at sandra@plymouthenergy.org. 

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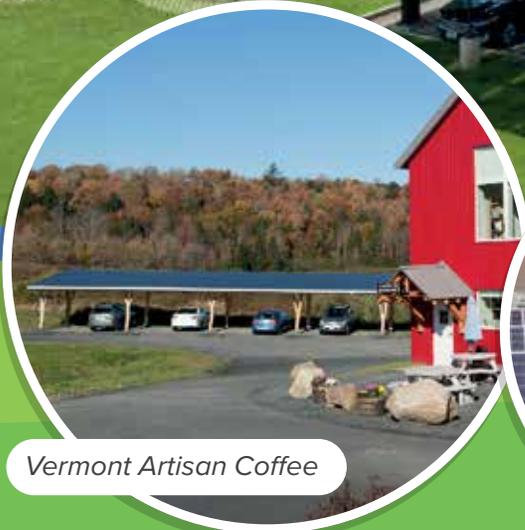
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Cont'd from p.12

use or time. They can be fully discharged without damage. They are based on stable and well-developed supply chains. They are safe, non-flammable and non-toxic. And they can be built at a very low cost, compared to other batteries. The smallest sizes Zinc8 plans to produce at present appear to be about what would be needed for a small group of households or a small commercial or industrial site, and the largest might be suitable for electric utility use.

Clearly, batteries of the type Zinc8 has developed could be expected to sell well. Filling that demand will mean establishing manufacturing facilities. And



Unlike lithium-ion technology, which requires new stacks in order to scale, Zinc8 has decoupled the linkage between energy and power. This means that scaling Zinc8's technology can be accomplished by simply increasing the size of the fuel tank and quantity of recharged zinc fuel.

since new factories in an area will mean new jobs, there are people who hope to attract Zinc8 to the places where they live to build a plant.

In July, it was announced that Senator Schumer of New York has been in talks with Zinc8 to build a factory in Ulster, New York, which is about 55 miles south of Albany on the Hudson River. The site that would be used for the new factory was formerly used as a dumping ground and is contaminated with asbestos. Cleaning it up and using it for a factory for manufacture of non-toxic batteries would be a win all the way around. ♻️



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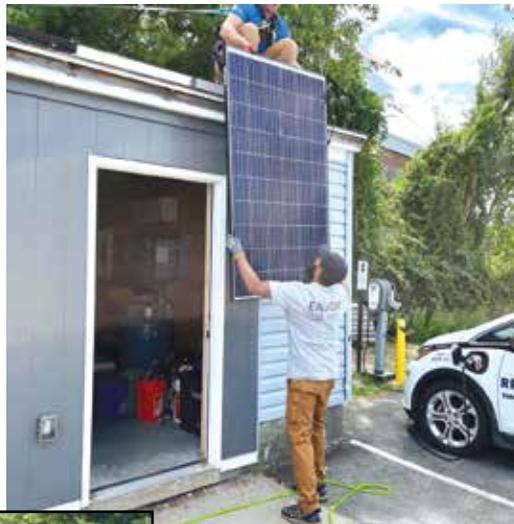
ReVision Energy is an employee-owned solar company on a mission to build a better, cleaner future and empower our communities to do the same. They take pride in having been mission-driven from the start. Their commitment to building a better world isn't just good for business; it is their business. The company embodies their values in every interaction with customers, suppliers, the community, and of course with each other.

In alignment with their mission, the ReVision Energy Electrical Apprenticeship Program (REEAP) was created in 2018. REEAP is the first of its kind employer-based apprenticeship program in the nation to provide in-house academic training that is required for renewable energy professionals to earn electrical licensure in Maine and New Hampshire. As a Department of Labor (DOL) registered apprenticeship program, REEAP provides a hybrid education inclusive of on-the-job learning, online instruction, and in-person instruction in a manner that complements the professional and personal lives of their employees.

The program fosters a safe and constructive work environment where all employee-owners have an opportunity to do professional, meaningful work by

utilizing different perspectives and rewarding people for their exemplary work. As a team, all are working to reduce fossil fuel dependence while alleviating the economic and social injustices amplified by the climate crisis.

ReVision Energy covers the cost of tuition, books, and training for REEAP for our employee-owners and provides the coursework to provide the installation team with the most integrated education possible while significantly streamlining the licensing process. As an in-house program, REEAP is designed to be the most worker-friendly registered apprenticeship program available by providing a better work/life balance than many conventional options. By combining online work with in-person training scheduled



Left: The ReVision Energy Electrical Apprenticeship Program (REEAP) hosted new solar installers from ME, NH, and MA at the So. Portland branch for REEAP's new PV101 training. Above: Led by REEAP Coordinator Ben Rubins, Safety Director Brad Costigan, Journeyperson Electrician Evan Provencher, and Journeyperson Electrician Caleb Turner, new electrical apprentices got dedicated time to review installation safety on the roof of the RETC training building.

around work obligations, the training schedule complements the lives in and out of work for apprentices. This flexibility allowed the training program to continue coursework throughout the COVID pandemic.

Being certified as a B Corporation is a validation of those efforts and places ReVision Energy in a community of over 4,000 like-minded businesses worldwide who all agree that business is not just about profit but can and should be a source for positive social and environmental change in the world. They received recognition in 2019, 2021, and 2022 by B Labs as a "Best for the World" company, meaning we were in the Top 5% of B Corps scores worldwide, due to their worker-friendly policies, improvement during B Corp re-certification, and overall positive impact of their business model.

ReVision Energy is growing their team of motivated, highly skilled solar professionals and redefining what it means to be a business for good along the way. If you're ready to learn, have a can-do attitude, and are passionate about making New England less oil-dependent and more equitable for all, explore our open positions below and join the fight for our future. Learn more at revisionenergy.com.

Wind Energy Training Program at VTC

Daniel Costin

As the program chair for the Renewable Energy Engineering Technology degree program at Vermont Technical College (VTC), I have oversight of the process to determine what subjects are taught. The key to this process is the involvement of an active advisory board from the renewable energy industry. These are the people who will be hiring our graduates.

So even though wind energy installation is stalled in Vermont, we are still teaching the class to our students. Here are some reasons. First, there are many opportunities in wind energy outside Vermont. The main ones are along the New England coast as projects such as Vineyard Wind are installed. In fact, part of the workforce development of that project is to create an Offshore Wind 101 class to be taught



Vermont Technical College students installing an anemometer (Courtesy photo).

in vocational schools, high schools, and community colleges in Massachusetts. Also, they are developing specific training programs for offshore wind technicians, which includes training on specific equipment to be installed. Our program at VTC has the

potential to support and supplement the training done for Massachusetts residents. Second, there are still opportunities at existing wind installations in Vermont. One-sixth of Vermont's electricity generation comes from wind power. Third, *Cont'd on p.28*

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FEDERAL INVESTMENT TAX CREDIT

- The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 26% of expenditures through 2022. For commercial geothermal generating systems, microturbines, and combined heat and power the ITC is 10% of expenditures.
- Residential Renewable Energy Tax Credit: <http://bit.ly/energy-gov-R-E-tax-credit>
- Biomass heating systems Tax Credit: 26% of the purchase and installation costs (with no cap or lifetime limit) for tax years 2021 and 2022; reduces to 22% of purchase and installation costs in 2023 (under Sec. 25D of the U.S. tax code)
- Electric Vehicles - Tax credit for qualified plug-in electric drive vehicles including passenger vehicles and light trucks. For vehicles acquired after December 31, 2009, the credit starts at \$2,500 and goes up to \$7,500 based on the battery specs.

USDA RURAL DEVELOPMENT PROGRAM

- USDA Rural Development Program - Rural Energy for America (REAP)
- Finance the purchase of renewable energy systems, and make energy improvements; energy audits. Funding is awarded on a competitive basis; grant funding cannot exceed 25% of eligible project costs and combined loan guarantees and grants cannot exceed 75% of eligible project costs.
 - Applicants include Feasibility studies/regular REAPs: agricultural producers and rural small businesses. Energy audits and renewable energy development assistance: local governments, tribes, land grant colleges, rural electric coops, public power entities. Grant must be used for Construction or improvements, purchase and installation of equipment, energy audits, permit fees, professional service fees, business plans, and/or feasibility studies. Find more at www.rurdev.usda.gov/NH-VTHome.html or call 802-828-6080 in VT or 603-223-6035 in NH

BIOREFINERY ASSISTANCE PROGRAM

USDA Rural Development offers opportunities to producers to develop biofuels through the Biorefinery Assistance Program. The program provides loan guarantees for the development, construction, and retrofitting of commercial-scale biorefineries.

- The Biorefinery Assistance Program was established to assist in the development of new and emerging technologies for the development of advanced biofuels and aims to accomplish the following:
- Increase energy independence
 - Promote resource conservation, public health, and the environment
 - Diversify markets for agricultural, forestry products and agricultural waste materials
 - Create jobs and enhance economic development in rural America
 - For more information go to www.rurdev.usda.gov/BCP_Biorefinery

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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 of new solar thermal and advanced wood pellet heating systems.

Advanced Wood Heating Advanced wood pellet heating 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. See www.rerc-vt.org or call (877) 888-7372.

- Retail sales of "Advanced Wood Boilers" are exempt from Vermont's 6% sales tax. <http://tax.vt.gov/exemptions>
- Residential Bulk Pellet Bins. Up to \$3,000 rebate.

- ARPA incentives for low- & Moderate-income Vermonters for wood stove change-outs, pellet heating, and bio-diesel (as well as any needed repairs for wood/pellet ventilation/exhaust systems. See details at www.RERC-VT.org

- Coal Change-out adder. Up to \$7,000 additional incentive for a pellet heating system if replacing a coal heating system. Businesses can get up to an additional \$27,000 incentive. Details at www.rerc-vt.org or call (877) 888-7372.

- **More into at fpr.vermont.gov/woodenergy/rebates**

In Rutland & Bennington, & NEK Counties (and towns in neighboring counties that boarder Rutland Co.), contact Melanie Paskevich mpaskevich@nwwvt.org at NeighborWorks of Western Vermont, (802) 797-8610 on incentives for wood stove change-outs, energy audits, and weatherization.

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.

- GMP rebates available through December 31, 2021

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 efficiencyvermont.com/rebates.

Lighting

- Special pricing on select ENERGY STAR® LED fixtures at Vermont retailers.
- LEDs for indoor growing: \$100 back for qualifying fixtures

Weatherization

- Comprehensive air sealing and insulation projects with an Efficiency Excellence Network contractor: 50% off eligible project costs, up to \$2,000. Moderate income Vermonters get 50% off up to \$5,000.

- 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
- 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: \$200 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 – finance up to \$20,000 in energy-related home improvements with interest rates starting at 0%. Restrictions apply.
- Additional incentives may be available through your local electric utility provider. Contact your utility for more information.

Incentives for Pro-environment Agriculture Behaviors

To protect the ecosystem around the Lake Champlain Basin, several programs have been introduced to encourage environmentally-conscious farming in the area by providing monetary incentives. A recent study has looked at two of these programs (<http://bit.ly/EQIP-CREP-study>), the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Enhancement Program (CREP). Both programs could benefit from reduced transaction costs and administrative complexity.

* Source: *Vermont Research News - Center for Research on Vermont*, 1.18.21.

Vermont's GMP Extends Rebates Through 2022

Green Mountain Power (GMP) is extending its popular rebate programs through all of 2022 to help more customers save money while reducing carbon emissions.

In 2021, GMP customers saved with more than 7,000 rebates when they made the choice to switch away from fossil fuel at home and on the road – for heating, driving, mowing their lawns, and electric motorcycles. 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.

The Vermont Natural Resources Council (VNRC) cut costs with GMP incentives while completing the renovation of a historic house in Montpelier to serve as new office and expanded meeting space.

"One of our goals was a net-zero building, and GMP's incentives were a huge help in swapping out an old, inefficient oil-burning boiler for cold climate heat pumps," said Brian Shupe, VNRC's executive director. "GMP's incentives also helped us install an electric vehicle charging station to help staff and visitors convert to electric vehicles."

In 2021, 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

NH DOE: All of NH DOE's programs, save the Residential Solar Water Heating Rebate Program are now OPEN.

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

-Currently closed, this program offers rebates to qualifying NH residents who install photovoltaic (PV) or wind turbine electrical generation systems. Rebate lev-

els are \$0.20 per watt of panel rated power up to \$1,000, or 30% of the total facility cost, whichever is less. **Check for updates for ALL Rebates at https://bit.ly/NH-DOE_ResidentialRenewableEnergy**

Residential Solar Water Heating Rebate Program

• Program is currently closed: \$1500 - \$1900 per system based on annual system output

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_ResidentialWoodPellet for more information and current program status.

LOCAL INCENTIVES

Many towns 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, EFL.

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

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

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

NHSaves: 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.

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: nhcdfa.org/energy.

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

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED IN NEW YORK

There are 169 programs and incentives available at: <http://dsireusa.org> (enter your zip code).

Also visit <https://www.nyserda.ny.gov/> All-Programs 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/>.

Clean Energy Incentives and Tax Credits for Renewable Energy

• **SOLAR:** The federal investment tax credit (ITC), which was scheduled to drop from 26% to 22% in 2021, will stay at 26% through 2022.

• **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>
- **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

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 weatherization rebates up to \$9,600 for income-eligible homeowners and up to \$5,500 to other Mainers. 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/>.

Heat and Cooling: Efficiency Maine offers 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 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: Residents of any income are eligible for heat pump rebates up to \$1,200. Income-eligible residents qualify for rebates up to \$2,400, and businesses are eligible for incentives up to \$4,800. Learn more at the Efficiency Maine heat pump website, bit.ly/EffME_HeatPumps.

Heat Pump Water Heaters: Efficiency Maine offers \$850 mail-in rebates or instant discounts on heat pump water heaters. Learn more at bit.ly/EffME_WaterHeatingSolutions. A Water Heater Cost Calculator to estimate savings is at bit.ly/EffME_WaterHeatingCostComparison.

Electric Vehicle Charging Solutions: Charging at a single-family home is convenient and inexpensive. Most EV drivers do over 80% of their charging at home using either a Level 1 charger cord or a faster Level 2 charger. For public sites or multi-family residential sites, installing EV charging can increase employee satisfaction, show sustainability commitments, strengthen relationships with customers and attract new ones. See bit.ly/EffME_Work_EVCharging.

Electric Vehicles (EVs): Efficiency Maine offers instant rebates for eligible battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) at participating Maine car dealers. Learn more at <https://www.efficiencymaine.com/ev/>.

The standard rebate is \$2,000 for a BEV and \$1,000 for a PHEV. Higher rebates are available for low-income customers, governmental entities, and select nonprofits. For a limited time, Efficiency Maine offers a promotion for businesses with five or more vehicles registered in Maine, paying rebates of \$4,500 on a BEV or \$3,500 on a PHEV for the first 50 vehicles on a first-come, first-served basis. Maine businesses can also receive up to \$8,000 for the purchase of an all-electric commercial van for business use. See bit.ly/EffME_EV_Rebates.

Commercial: Efficiency Maine has programs for businesses of all sizes, including multifamily buildings with five units or more and Maine's largest energy customers. Examples of eligible organizations include businesses, for profit or nonprofit; municipalities; schools and higher education facilities; manufacturing and other industrial facilities; other non-residential facilities; and multifamily and condominium buildings with five or more units. To learn more about Efficiency Maine's incentives for the commercial and industrial sector, commercial 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 go here: https://bit.ly/EffME_BusinessSolutionsPartner.

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

Room Air Purifiers: \$25 rebate available for ENERGY STAR® certified room air purifiers: bit.ly/EffME_AirPurifier_Rebate.

NEW ONLOGIC GLOBAL HEADQUARTERS SHOWCASES COMMITMENT TO SUSTAINABILITY

Michael J. Daley

OnLogic (www.onlogic.com), with its June 1, 2022 groundbreaking for a new headquarters at Technology Park in South Burlington, Vermont, took a significant step to support the phenomenal growth of the company while fostering a sustainable relationship with planet Earth. OnLogic designs and builds industrial computers and technology solutions for use in challenging environments. Founded in 2003, OnLogic has offices in the U.S., Netherlands, Taiwan and Malaysia. It has seen 30% yearly growth, helping more than 70,000 customers worldwide solve their unique computer needs.

In addition to a wide range of industrial applications, OnLogic systems are used in solar farms, wind farms and hydroelectric installations for data aggregation and analytics, where they must be able to withstand extreme temperatures and be relied upon to operate 24/7. Many municipalities and utilities companies also use their hardware for power grid management systems. Their rugged systems are rated for operation in ambient temperatures as low as -40°C and as high as 70°C.

Currently, OnLogic's 150 Vermont employees work from a pair of locations in the Burlington area. The new \$60 million, 140,000 square-foot global headquarters will centralize operations and accommodate anticipated growth for the next seven to ten years. Sustainability features include:

- 640kW roof-mounted solar array, which



Rendering of OnLogic's new headquarters at Technology Park in South Burlington, Vermont. (Illustration courtesy of Wiemann Lamphere Architects)

is expected to cover the majority of the project's HVAC load and offset the equivalent of 60 homes per year.

- A geothermal mechanical system which, when compared to a code-compliant conventional HVAC system, will save approximately 1,574,308 pounds of CO2 per year.
- Twenty-four Level 2 electric vehicle (EV) chargers for use by the OnLogic team.
- Full building automation system designed to minimize energy usage.
 - Responds in real-time to building use and grid needs (peak shaving-capable).
 - Custom built in partnership with OnLogic engineers and designers.
- Foam glass gravel sub-slab insulation by Glavel Inc., locally sourced from Essex, VT

will result in an 87% reduction in carbon compared to traditional rigid insulation.

[See the Weatherization article on page 30 in this issue to further understand the importance of this choice. -Ed.]

OnLogic has assembled an experienced and environmental award-winning team for the project including the Vermont based companies ReArch as lead contractor and Wiemann Lamphere as lead architectural firm.

Green Energy Times discussed this project with OnLogic Team.

G.E.T.: Can you describe a bit of the in-house process that led to the new headquarters and the commitment to a sustainable design? Did that requirement come from your team or arise when you

chose a design firm?

OnLogic: Sustainability has always been a pillar of OnLogic's social mission, from reducing packaging materials, to engineering products that use less power and last longer, and more. We already practice a range of sustainability measures in our current building in South Burlington, and the new building gives us the opportunity to further enhance our impact. From the beginning we knew we were going to explore solar, EV charging, and geothermal. ReArch and Wiemann Lamphere Architects (WLA) helped us assess the viability and brought additional ideas from their combined extensive experience.

G.E.T.: What qualities and skills led you to choose ReArch and the architect firm Wiemann Lamphere? At what point did they join the planning process?

OnLogic: We began designing for this expansion in 2017 with WLA. They have a solid understanding of what we are trying to do, and they bring a wealth of experience to the table. That effort was stalled due to wetland impact

Cont'd on p.31



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IMPROVING LIVES THROUGH THE BUILT ENVIRONMENT

ADDRESSING INFLATION, HIGH GAS PRICES, AND POLLUTION

John Gage

Many of the economic problems we are experiencing today (high gasoline, energy prices, and inflation) are caused or compounded by our over-reliance on fossil fuels (coal, oil, and gas) and the unavoidable price volatility in the global oil and gas markets. Ending our dependence on fossil fuels will provide economic stability, better health and national security, and address the main cause of global warming. But we also need solutions that help people through their current financial difficulties.

Some quick fixes have been proposed, such as temporarily suspending the federal gasoline tax. While doing so would slightly reduce costs at the pump, fossil fuel producers would likely absorb one-third of the reduction for profit. A federal gas tax holiday is not a cost-efficient or powerful way to help household budgets, and it would do nothing about gasoline use.

Some questionable long-term fixes have also been proposed, such as significantly increasing U.S. oil and gas production by easing regulations. But it is not feasible for the U.S. to produce enough to control global prices, so OPEC and Russia will always have leverage to have an effect on the U.S. economy as long as we remain dependent on those fuels. And even if it were possible to produce our way to oil and gas price stability, doing so would be catastrophic for our climate.

Neither of those proposals would help household budgets much or at all in the near term, and both wedge us further into the high-polluting fossil fuel dependency trap in which we find ourselves.

A better approach is to take this opportunity to make our economy more energy-efficient and accelerate the transition to clean energy solutions, to become more economically resilient and healthier from less pollution. We can do that with policies that reduce emissions, protect budgets, and keep U.S. businesses competitive in the global market.

A Price on Pollution is Required

Putting a price on pollution is the most powerful and cost-effective way to reduce it. In the case of climate pollution, this means putting a price on carbon emissions from fossil fuels. Experts, including the IPCC and U.S. Treasury Secretary Janet Yellen, say we cannot adequately address climate change without carbon pricing. But is this the right time to do it? Charging fossil fuel producers and importers a fee for the carbon pollution from their products will have the trickle-down effect of raising the price of gasoline, heating oil, and many other things. That would reduce emissions, but millions of Americans are already struggling to afford high fuel, electricity, housing, and food prices.

Cash-Back Carbon Pricing to the Rescue

Paradoxically, this may be the perfect time to price carbon. High energy prices, inflation, and the climate crisis are on people's minds, and they want solutions. Now is a great time to talk about the number one expert-recommended cost-effective and equitable way to reduce pollution and decouple our economy from its dependence on fossil fuels – cash-back carbon pricing – because most people will benefit financially. Cash-back carbon pricing puts more money in most people's pockets. The extra spending power it provides will help people cope with the current high prices and inflation, because the largest benefit goes to those with the smallest carbon footprints, low-income families.



High gasoline prices reflect OPEC's failure to resume supply to meet demand after the 2020 Covid shutdown, the international boycott of Russian oil in protest of the war in Ukraine, and aggressive profit-taking by U.S. oil and gas majors. (Michael O'Keene/Adobe Stock Photo).

What About Inflation?

Inflation is a global problem, but some countries are fairing better than others. Canada began using Carbon Fee and Dividend a few years ago, and inflation there is less than that in the U.S. A study by Regional Economics Modeling Inc. (REMI report) found that Carbon Fee and Dividend would increase inflation by just 2% over 20 years while reducing carbon emissions by over 50%. Another study on Canada and the EU suggests carbon pricing may even be deflationary.

Putting Relief into Perspective

The recently proposed three-month gasoline tax holiday would save the average person about \$14 according to analysis from the Wharton School at UPenn, and sacrifice \$6 billion in infrastructure funding. According to the REMI report, the average personal net gain in the first year from Carbon Fee and Dividend is about \$45 (and rising to \$500 by the tenth year and \$800 by year twenty). In short, sending people carbon cash back is a better way to help families afford the gasoline they need today.

Rather than using policies that incentivize pollution and extend fossil fuel use, Congress would be wise to address the biggest problems we face today with cash-back carbon pricing. A strong carbon price will bring our economic dependence on fossil fuels to an end by unleashing the investment, innovation, and transition in the clean energy solutions we need for a safe future. The cash-back dividend will help people cope with high prices and inflation today.

The best path forward for households, businesses, and our climate is clear. We can each help create the political will to enable Congress to pass Carbon Fee and Dividend legislation by asking them at congress.gov/contact-us.

John Gage volunteers with Citizens' Climate Lobby as state coordinator for NH. 

How Cash-Back Carbon Pricing Works

Carbon Fee and Dividend is a simple three-part cash-back policy:

Charge fossil fuel producers and importers a steadily increasing fee based on the carbon emissions from the products they sell. Start at \$15 per ton of CO2 and increase the fee by \$10 yearly until emissions-reduction targets are met.

Rebate the money collected to all American households on an equal basis each month. Two-thirds of all households will receive more in their monthly share than they pay in trickle-down higher prices from the fee.

Use "border carbon adjustments" to charge our carbon price on imports from free-polluting countries and rebate our exporters, to keep U.S. businesses competitive and strongly encourage other countries to match our carbon price.

The carbon fee will drive down carbon emissions at the necessary scale and speed. The monthly cash back will protect budgets, and border adjustments will enable us to harmonize climate policy among trading partners.

Reaping the Benefits – Cont'd from p.1

to spike natural gas prices, it's just the latest in a long line of geopolitical, weather, and economic events contributing to oil and gas price volatility. Though Vermont's utilities also purchase power from the New England grid, much of the state's electricity comes from longer-term contracts with renewable and nuclear facilities insulating Vermont from severe price spikes.

As climate change upends our weather patterns and international conflicts proliferate, relying on sustained, low prices for fossil fuels is a sucker's bet. From this vantage point, it is easy to see what we need to do now to protect ourselves going forward. It's time to double down on renewable energy, especially renewable energy that we generate right here in Vermont. Seriously investing in renewables, with their near-zero generating costs, is the key to keeping our electric bills down in the future.

Once upon a time, renewables were mainly an "eat-your-vegetables" solution to climate change – something that we knew we had to do but weren't always excited about. Change can be hard, wind turbines and solar panels were expensive, and utilities were worried about how to manage the variable power output that wind and solar produce. But increasingly, renewables



are paying dividends not just in terms of how they protect the climate – reason enough to eat our vegetables – but also in terms of price and reliability. On price alone, new wind and solar outperform coal and are competitive with natural gas. Newer generation panels and turbines are more efficient than ever at capturing energy from the wind and the sun. Better weather forecasting, expanding energy storage, and innovative solutions for shifting electricity demand to times with excess generation are making it easier and easier to integrate renewables into the grid. In Texas, hardly a state known for its climate-friendly outlook, renewable energy is being credited

with keeping the grid operating while Texans crank up the air conditioning to cope with record-breaking early heat brought on by climate change. Recently, wind and solar produced 40% of the electricity Texas used during periods of peak demand. (Oh, and regarding those massive power outages in Texas last winter that the fossil fuel industry and their allies were so eager to blame on wind power? It turns out those were actually caused by natural gas plants and pipelines freezing up!) Rather than simply being the best option to combat climate change, renewables are increasingly the best option, period – including for keeping rates down and the grid operating.

To ensure that Vermonters continue to reap the benefits of renewables, we should be updating our energy laws to require utilities to purchase 100% renewable energy and at least double our goals for in-state renewable generation, to 20% or more by 2030. Bringing more renewable energy to Vermont means more on-site solar installations – on rooftops, over parking lots, or mounted in backyards. It means community solar arrays so that renters and low-income Vermonters can access renewable energy, and investing in storage. It means getting back to building responsibly-sited wind projects in Vermont. Building renewable facilities in Vermont means that we can take control of the environmental impacts of the energy that we use rather than asking others to bear those burdens for us. Looking back, it is clear that Vermont's policymakers had the foresight to protect Vermonters from the rate turbulence that is rocking New Hampshire and much of the rest of the country. Let's exercise that foresight again by acting today to ensure that Vermont's future is renewable.

Jonathan Dowds is the Deputy Director of Renewable Energy Vermont. 

HEAT LOCALLY TO COOL GLOBALLY

Jessie Haas and G.E.T. staff

Wood pellets save you money, but are they really all that green? The answer in the Northeast is: yes.

It's partly a matter of geography. Europe destroyed most of its forests centuries ago. Now, with laws intended to reduce their use of coal in power plants, they are burning pellets from clearcut industrial monoculture plantations in the southeastern United States. Unsurprisingly, that model has not proved sustainable.

But forestry looks very different here in the Northeast. The wood used in pellets comes from a variety of sources. Some is sawdust from lumber mills and furniture manufacturers. Some pellets are made from wood chips. But much of the wood for pellets is cut for the purpose from areas in the many thousands of acres managed under forest stewardship plans overseen by state foresters, the Forest Stewardship Council, or other certifiers. The wood is harvested by local loggers sustainably in ways that protect wildlife habitat. Properly tended, our mixed forests regenerate, and the inventory is growing.

Heating with wood pellets works within the natural forest carbon cycle, while fossil fuels release ancient carbon into the atmosphere. Pellets mitigate greenhouse gas emissions and harmful pollutants such as CO₂, sulfur dioxide, and mercury. They also emit less particulates than most wood stoves. And pellet proponents point to reduced emissions of methane

compared to natural rotting of dead wood in forests.

Companies that sell pellets are very aware of other types of good environmental practice. Pellet mills are geographically dispersed, reducing

emissions associated with transporting the pellets. Similarly, dealers and manufacturers typically deliver only to customers within a certain range of their warehouses.

Wood pellets are dense and have a low moisture content. This means more of the energy from combustion will go toward heating the building, rather than boiling off the water content. They can be burned with a very high combustion efficiency in boilers and furnaces specifically designed for them. All brands have similar moisture content of around 8%. The higher the energy content (BTUs per pound), the hotter the burn. Numbers should be around 8,000 BTU per pound or higher.

For a consumer, some of the most im-



Bourne's Energy pellet truck delivering bulk wood pellets in Plainfield, VT. (Bourne's Energy)

portant considerations for buying wood pellets may be where they were made, what percentage is from hard or soft wood, and the percentage of ash. Low ash content reduces waste and maintenance. A

ton of pellets with 0.3% ash content will produce six pounds of ash; with 1% it will produce 20 pounds.

Generally, it does not matter whether you burn hardwood or softwood pellets. Due to their compression, they are about equally dense. Softwoods can actually have 10-20% more BTUs by weight, due to their resin content. Some manufacturers use a mix of both, and some produce a 'regular' and a 'premium' grade pellet, but the grades are not standardized. A close read of the bag may reveal contents such as paper, cardboard, glue and bark, all of which burn less hot and will be less efficient in your stove; those are not generally found in premium pellets.

People often ask why a ton of wood pel-

lets seems expensive compared to cord wood. One important reason is that fresh wood chips contain up to 50% moisture and the pellet manufacturers have to drive off most of that moisture. This uses energy and significantly reduces weight.

Many people buy pellets in 40-pound plastic bags, but it is possible to choose bagless bulk delivery. To do that you can build or buy an indoor or outdoor storage bin. A bulk fuel company delivers to you two or three times a year, just as the heating oil company does.

Several local companies supply high-end boilers, usually made in Europe, which offer the consumer an experience similar to an oil furnace: automatic heat that's easy to regulate, without lifting. For example, Pellergy LLC, a Vermont company, has been selling wood pellet burners, boilers, and storage units since 2006. In 2013 they began importing Windhager BioWin boilers made in Austria. These extremely advanced boilers are thermostatically controlled and when coupled with bulk wood pellet storage can provide homeowners with months of hands-free, maintenance-free renewable heating. These boilers offer fully automatic ash removal and a dual ignition system for greater reliability. They come with standard North American wiring. Pellergy trains local home heating technicians to install and service these central heating systems and also to meet the needs for custom or semi-custom design. Pellergy's website is pellergy.com.

Froling Energy of Peterborough, NH, also installs and services pellet boiler systems. Froling emphasizes the difference between its systems

Cont'd on p.21

Cheap Gas Is Over – Cont'd from p.1

revolution "an unmitigated disaster" for investors. According to a survey done by the Federal Reserve Bank of Dallas, 60 percent of shale executives said they weren't increasing drilling activity because they didn't want the high prices to end.

Finally, anyone suggesting that the solution to expensive natural gas is more pipelines to

bring in more natural gas has a bridge to sell. Unlike the gas price spikes we experienced in the winters of 2012 through 2018, this latest increase is more about fuel prices and less about pipeline capacity. In part thanks to warm temperatures, on only a few days this winter did our pipelines approach capacity. Moreover, other states have implemented policies that seek to reduce gas demand and the few peak winter days when capacity is a problem, policies that save New Hampshire residents' money.

In other words, it's not the infrastructure. The era of cheap American gas is simply over.

There are solutions, but—like our two-decade gas-building binge—they will take time. As such, perhaps it's no surprise that politicians from both the major parties are looking for policy solutions that can be implemented before the next election, such as gas-tax holidays or one-time electric bill credits.

But the truth is, as Robert Frost wrote, I can see no way out but through. We need to build ourselves out of this crisis.

We at Clean Energy New Hampshire have a whole package of technologies we believe will lower the amount of money



consumers spend on energy every year: solar on every roof, insulation in every attic, a smart meter and smart appliances connected to the grid, heat pumps outside, and an electric car in every garage. This is the life our family is living, and I'm happy to show anyone who asks the spreadsheet of our energy

costs.

In this price environment these investments pay back even faster, which means this is where the markets will take us eventually. However, if we want to get there faster there is a suite of policies that help families choose each of these technologies, if we have the courage to adopt them.

But since we're laser focused energy rates right now, let's talk about how to use clean energy to lower them.

In Maine last year, following a competitive bidding process, utilities awarded long-term contracts to six large-scale renewable energy projects. Those projects will deliver energy to residents of the Pine Tree state for between 3 and 4 cents per kilowatt hour. Compare that to the 22 cents that Eversource and Liberty got when they went to the gas-dominated market in these past two weeks.

New Hampshire lawmakers could authorize our utilities to issue a similar request for proposals in the next legislative session, or sooner if they have the courage.

Procurement for long-term contracts with renewable energy providers is increasingly the norm. In Texas—in the wake of the blackouts caused by the freezing up

of their natural gas system, and this year's heat wave in which renewables staved off further outages—utilities have been issuing solicitations for hundreds of megawatts of renewable energy contracts. Megawatt competitive solicitations are not a subsidy, they are simply a different financing arrangement that recognizes that renewable energy projects have free fuel and high capital costs and require different market structures than fossil fueled power plants.

The truth is that nearly no-one believes natural gas is our future. Governor Sununu acknowledged this, stating that we are in the midst of a transition to renewable energy. A glance at the queue of power generation projects proposed in New England tells the story. In 2017, 48 percent of the proposed capacity was gas, and in 2022 only 3 percent was. Meanwhile, wind, solar, and battery storage represent 95 percent of what's proposed.

The only question is whether the lower energy rates that result from those projects will flow to other New England states or if we'll really do something to help New Hampshire ratepayers.

Sam Evans-Brown is executive director of Clean Energy NH. ♻️



Wikimedia Commons/MarkBuckawicki

IT'S TIME TO THINK SOLAR

G.E.T. staff

With inflation, rising interest rates, and a world that feels out of control, it is no surprise that many people are feeling insecure about their futures.

Some people wonder about what effect rooftop solar systems have on the value of their property. It has been three years since an article by Bobby Tetsch, CEO and Founder, Chino, CA-based Modern Pro Solutions, appeared in Grit Daily. Tetsch said in that article, "It is time to think Solar. At times like this, homeowners have to use every tool in the toolbox, and solar installation is a vital one to contain and reduce monthly costs. Buying a home that has a solar system, or having one installed upon purchase is a savvy financial move that also benefits the environment." (bit.ly/Time-for-solar)

Many things have changed since that article appeared. We have been hit by a Covid-19 pandemic, the Washington administration has changed, there is a war in Ukraine, and now, because of that war, fuel prices have increased wildly, and the Federal Reserve seems inclined to increase interest rates. But the value of Tetsch's advice is not diminished by the passage of time.

Tetsch referred to a 2019 Zillow study, which indicated that homes with solar panels sold for 4.1% more than those without. (<https://bit.ly/Solar-homes-sell-for-more>) Given the changes we have seen, it seems solar is probably worth even more.

The Modern Pro Solutions website is modernprosolutions.com.

Many thanks to our sponsor:



<< Cont'd from p.20

and the more familiar pellet stoves. "Pellet stoves are semi-automatic space heaters. Pellet boilers are automatic, just like oil and propane boilers, and with burn efficiencies and particulate emissions that are quite comparable." Some can be hooked into your home's existing heat distribution system, be it hot water or hot air. The Froling website is frolingenergy.com.

Froling Energy also produces Precision Dry Chips, or PDCs, locally-sourced wood chips that are dried to 25% moisture content and are screened to exclude oversized chunks that could clog boiler feeding systems. PDCs can be burned in dual-fuel boilers which can also burn pellets. These boilers are used in commercial buildings, schools, factories, and other large buildings. Dried wood chip boilers are large and are ideal in buildings where



Precision dried wood chips in the Froling Energy warehouse ready to be trucked to a customer. (Froling Energy)

annual consumption would exceed 20,000 gallons of oil. (See the October 2021 issue of Green Energy Times for more information).

TARM Biomass is another local supplier of high-efficiency wood-burning boilers manufactured in Germany by Fröling, along with heating units from a number of other companies. They offer pellet boiler heating systems for homes as well as commercial-scale wood chip boiler systems. They have systems for use with pellets, chips, and cord wood.

Like other companies in the wood heating business, TARM is very conscientious

about environmental issues and sustainability. They make this statement at their website: "We know that what we do is only sustainable if our products burn cleanly and operate efficiently, cost little to operate, and exceed our customer's expectations. Our team encourages a professional installation by trained dealers because we know that quality starts with the equipment and ends with the experience. Like you, we are Feeling Good About Wood." TARM is based in Orford, New Hampshire.

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Its website is woodboilers.com.

Following harvest, wood products may come under the management of a company like Cousineau Forest Products of Henniker, New Hampshire, a major broker of wood chips and other biomass fuels. Cousineau picks up and trucks wood products to users to be turned into electricity, paper, Masonite (or hardboard siding and similar products) and MDF (medium density fiberboard), and bark mulch, as well as chips and pellets for

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Cousineau says, "We provide a top-quality service to the producers of these raw materials by handling the trucking and providing the best available markets for the highest dollar. We also provide an end user service for these raw materials as well, by providing them with a reliable supply of the products they need to run their businesses." The Cousineau Forest Products' website is cousineauforestproducts.com.

Cont'd on p.27



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ACCELERATING CLIMATE CHANGE AND THE LIVING EARTH



Dr. Alan K. Betts

As climate change accelerates, we are seeing many extreme events which have never occurred before. I am going to discuss a set of these and put them in the context of the Earth.

Fifty years ago, I realized we were heading for a climate catastrophe, because no one accepted responsibility for the Earth. So, I asked, "How do we merge science with wisdom?". My forty-year journey was published as "The Earth's View of Climate Change" in March 2022 (alanbetts.com/research)

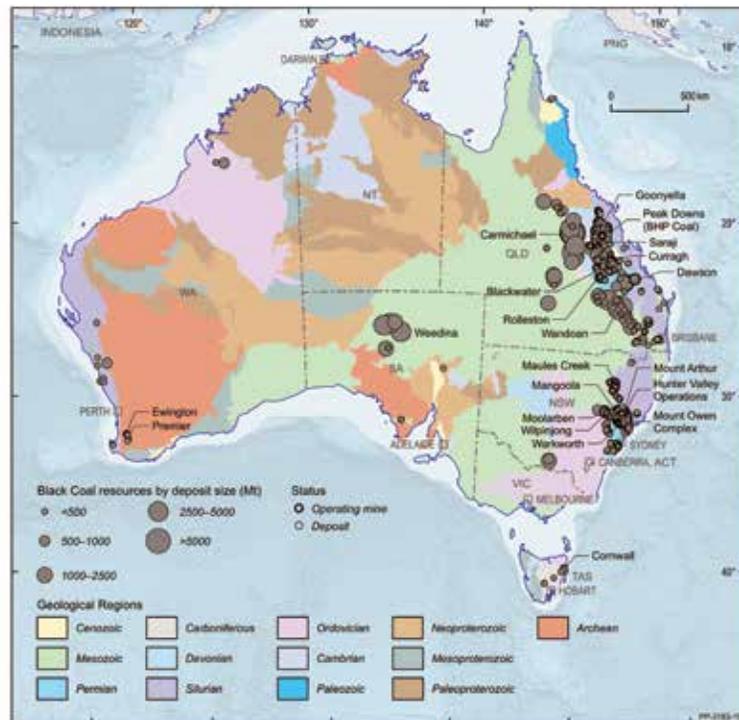
Our scientific perspective used to be that the 10,000-foot-thick E. Antarctica ice sheet would be stable for centuries. However on March 19, 2022, a new temperature record was set at the Concordia weather station on the E. Antarctica plateau that was 70oF above the 30-year climatology, as the desert air over Australia was advected to sit over this ice-sheet. One stunned scientist said, "If you had told me three days ago this would happen, we would never, never have believed you." Overnight, they glimpsed a new world, where a 20-foot global sea-level rise from the combined melt of the Greenland, Arctic and Antarctic ice sheets becomes a possibility within decades.

This is one way the Earth can deal with us. Our attitude is that we are in charge, and we can make money even if the earth is destroyed. So, take a deep breath. I have the advantage that my perspective is based on what the living Earth has shown me directly.

Hurricane after hurricane has damaged oil wells off the Texas and Louisiana coasts, and we rebuild them. But the Texas freeze in February 2021 was a radically new event.

This originated in the stratospheric oscillation over the North Pole, propagated down into the Arctic troposphere and then southward as a series of freezing blobs that sat over Texas, freezing and destroying infrastructure for two weeks. The Texas infrastructure was not winterized, and much of the electrical power system shut down. From the Earth's perspective, the real target was the Texas oil refineries, which suffered more damage from this February freeze than any major hurricane.

In late June and into July, 2021, the most extreme heatwave ever recorded in the northwest U.S. and into British Columbia (BC) had widespread temperatures over 100oF. The small town of Lytton in southwest Canada was warmer three days in a row until it reached 121oF. Imagine Death Valley temperatures in a Canadian forest. On the fourth day Lytton simply caught fire and burnt down. This extreme broke the all-Canadian temperature record, set during a drought in southern Saskatchewan 80 years ago, by an unimaginable 8oF. Canada was stunned. The extreme temperatures led to widespread fires that burnt and destabilized hillsides. The Earth was still planning ahead. In mid-November 2021 an atmospheric river off the Pacific dumped a month of rain on the region in two days. This generated massive mud and debris slides that closed the Trans-Canada Highway and national



Black coal deposits and operating mines in Australia (Aussemmaps)

railway line. To us a 'supply-chain interruption' but useful from the Earth's perspective, as BC is mining and liquefying natural gas and exporting products from the tar sands of Alberta, all to speed the destruction of life on Earth.

Eastern Australia is experiencing new record floods in Queensland and New South Wales after devastating wildfires in the region. The latest catastrophic flood around Sydney was July 2-4, 2022. A huge storm cell brought a year's worth of rain in three

days to some areas and led to the evacuation of 85,000 people, as their homes were flooded. The Earth's reason is apparent in the maps of the many coal mines around Sydney (and in Queensland). Companies were enjoying cash profit margins of about 45%, and mining more than ten billion tons of coal per year. No-one is discussing the connection. Instead, the claim has been made that Australia is not responsible for the climate consequences as the coal is burnt elsewhere!

On one level society understands the accelerating climate crisis is out of our control unless we rapidly cut the burning of the fossil fuels, which we have refused to do for decades, because it is so profitable. So the living Earth, which is responsible for life on earth, is taking over and targeting our fossil infrastructure, as well as planning to flood

our coasts. So far we refuse to discuss the implications of this, since we pretend we are the smart species in charge. The reality is we have to surrender to the Earth's perspective, but this is so hard for most to grasp when centuries of militarism has trained us to fight, fight and never surrender. Nonetheless the Earth can read our minds and patiently wait for us to glimpse reality!

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



The Importance of New England Forests

John Bos

There was a time in New England, once heavily deforested in colonial days, when it became one of the most densely wooded areas in the world, thanks to forests that regenerated over the past 150 years as farms were abandoned for city life.

But that reforestation began to peak in about 2010 according to a 2017 Harvard Forest report entitled "Wildlands and Woodlands, Farmlands and Communities." At that time, New England began losing 65 acres of forest to development each day. At the same time, funding for land conservation fell to 50 percent after 2008. Annual forest conservation also fell more than sixfold since the early 2000s, from 333,000 acres a year to about 50,000 acres a year since 2010.

"Peak forest cover is over in New England," said Jonathan Thompson, a senior scientist at Harvard Forest and one of the report's 31 authors. "If current rates continue," Thompson wrote, "New England will lose another 1.2 million acres by the year 2060 - that's an area nearly twice as big as Rhode Island."

In a 2021 study titled, "Avoided Deforestation: A Climate Mitigation Opportunity in New England and New York," prepared for the United States Climate Alliance Natural and Working Lands Research Program, Dr. Christopher A. Williams and Dr. Natalia Hasler Li Xi, quantify how much mitigation could be achieved by avoiding these kinds of forest to non-forest conversions. The study also measures the loss of carbon sequestration that would have occurred had these forests remained intact.

Deforestation across northeast America as the result of development, agriculture and other land uses, is one more release of unwanted CO2 into the atmosphere accelerating our climate crisis.

The core cause of this deforestation, and of most other environmental damage, is America's addiction to bigger and better. Economist Herman Daly, in the July 24 Sunday Times magazine, describes this addiction better than I can. "Growth is the be-all and end-all of mainstream economic and political thinking. Without a continually rising G.D.P., we're told, we risk social instability, declining standards of living and the loss of pretty much any hope of progress," Daly said. "But what about the counterintuitive possibility that our current pursuit of growth, rabid as it is and causing such great ecological harm, might be incurring more costs than gains?"

Daly is a long-time advocate of a steady-state economy, one that forgoes the insatiable and environmentally destructive hunger for growth, recognizes the limitations of our planet and instead seeks a sustainable economic and ecological equilibrium.

You don't have to be an economist or a forester to comprehend how much forestland can be lost to building roads, housing and commercial developments.

The purpose of the "Avoided Deforestation" study is to provide actionable information that can inform the general public and assist states with greenhouse gas emissions and removal inventories as well as with plans to explore avoided deforestation as a necessary component of climate mitigation initiatives.

Protecting and expanding the carbon stored in forests belongs to a suite of "natural climate solutions" - defined as protecting, restoring, and better managing forests, grasslands, farms and wetlands to reduce and remove carbon emissions and safeguard the climate system. Thus, slowing the pace of forest loss (avoiding deforestation) is an important instrument in the fight against climate change.

To begin to achieve the mitigation of deforestation, state governments need to have a baseline of what the loss of forestland has been. The Climate Mitigation study provides this basic information for a number of states.

Massachusetts averaged about 5,125 acres of forest loss per year in the early 2000's, committing 1.3 million metric tons of CO2e (carbon dioxide equivalent) to the atmosphere as carbon emissions plus foregone sequestration each year.

Maine averaged about 4,628 acres of forest loss in the early 2000's, committing 1.1 million metric tons of CO2e to the atmosphere as carbon emissions plus foregone sequestration each year.

New Hampshire averaged about 2572 acres of forest loss per year in the early 2000's, committing 0.7 million metric tons of CO2e to the atmosphere as carbon emissions plus foregone sequestration each year.

Vermont averaged about 623 acres of forest lost per year in the early 2000's, committing 0.2 million metric tons of CO2e to the atmosphere as carbon emissions plus foregone sequestration each year.

President Biden's Earth Day executive order protects old-growth forests, which

is essential. But it also calls for advancing "forest-related economic opportunities" - the kind of wording that often serves as a euphemism for allowing industrial-scale logging in national forests and on other publicly owned land.

America's forests are essential to climate change mitigation, absorbing carbon dioxide equivalent for more than 10% of U.S. annual greenhouse gas emissions. That noted, I believe each New England state is more aware of the importance of its own forestlands than the federal government. The question is, what will they do to stop deforestation not to mention preserve the natural habitat that is their New England heritage.

John Bos is a contributing writer for Green Energy Times. His bi-weekly column "Connecting the Dots" is published in numerous other regional newspapers. Comments and questions are invited at john01370@gmail.com.



Conserved forests like those around the Quabbin Reservoir provide clean drinking water to millions of New England residents without the need for filtration plants. (Clarisse Hart)

What Can One Person Do?

Janis Petzel, M.D.

Let me let you in on a little secret: you don't have to suffer, go broke, or eat outlandish food to take personal action on climate change, no matter what internet rumors tell you. In fact, as weird weather gets worse and the price of electricity and gas go up, clean energy and old-fashioned energy conservation actually make your life more comfortable, less expensive and less stressful. Plus, you don't have the ethical dilemma of harming other people to get your own needs met as you do when burning fossil fuels.

How often do you get such a clear opportunity to do well by doing good?

The catch? We need affluent people to buy into a clean, green lifestyle. Overconsumption by the top 10% of earners creates 50% of greenhouse gas emissions. In contrast, the bottom 50% of people create 12% of emissions. A 2020 article in Nature Communications states, "These findings mean that environmental impact is to a large extent caused and driven by the world's rich citizens."

This data gives new meaning to the term filthy rich. The higher your income above the 50% income line, the more damaging your lifestyle is likely to be to the environment. The CO₂-eq footprint of the top 10% in North America is 73.0 tons per capita per year, the highest in the world; the middle 40% of earners—26.7 tons; the bottom 10%—9.7. The world average is 6.6 tons CO₂-eq per capita per year. If you're living at or below a few times

the poverty level, you are not the problem. You are, however, likely bearing the brunt of the health effects of petroleum and chemical pollution.

What can you do? Start with a personal commitment to do what you can. Starting today.

Vote and volunteer: Social justice, education, healthcare access, clean energy, and environmental stewardship all reinforce each other. Support organizations and vote for candidates with good track records in these areas.

Close to home: The items with the most bang for your carbon-reduction buck are what you eat (eat more plants, reduce beef and meat consumption); how you get around (avoid machines that run on gas, oil or diesel); how much stuff you buy (less is better), how much you waste (less is even better); how you heat your home (don't use fossil fuels), and the electricity you buy (make your own with solar panels, sign up for community solar or chose your utility's greenest electricity option).

Why not be an influencer in your neighborhood? We know that once one house installs solar panels, more houses in the neighborhood get solar, too. It's exciting to be first.

It's even more exciting to be energy-independent. When gasoline got over \$5 per gallon, our family didn't feel it thanks to our all-electric car. When Central Maine Power almost doubled their rates? It didn't affect us directly. We make our own elec-



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tricity with rooftop solar. We pay less than \$15 per month for our heat, cooling, hot water and fuel-power for the car (the grid connection fee).

As rates and gasoline prices go up, our payback times for our solar panels, heat pump, heat pump hot water heater, and electric vehicle have dropped and keep dropping.

An important note. Contrary to propaganda, our solar panels are not costing anybody else higher rates. For support, read Freeing Energy by Bill Nussey, which explains why this is much better than I can (see book review in G.E.T.'s February 2022 issue).

Even if you can't afford green technology, energy conservation is the greenest of green actions. Good windows; insulated window shades; awnings and overhangs to cut down on heat gain in the summer; good insulation; LED lights; turning down the thermostat; energy-efficient appliances;

line drying your clothes; and strategic planting of shade trees, all reduce your energy use.

Your actions and opinions are important to keep us, and our elected officials, moving forward into a clean energy future. As I write this, there is a glimmer of hope that the U.S. Senate will actually pass climate-oriented legislation.

What can one person do? A lot. I urge you to do what you can to get fossil fuels out of your life. Today is a good day for the tail to start wagging the dog.

Links provided in the online posting of this article at greenenergytimes.org.

Janis Petzel, MD is a physician, grandmother and climate activist whose writing focuses on resilience, climate, and health. She lives in Islesboro, Maine where she advocates and acts for a fossil-fuel free future. She serves on the Islesboro Energy Committee and is a Climate Ambassador for Physicians for Social Responsibility. ♻️

BOOK REVIEW:

To Be a Water Protector: THE RISE OF THE WIINDIGOO SLAYERS

by Winona LaDuke

Fernwood Publishing, Published December 2020, 320 pages

Review by Joanne Coons

The book *To Be a Water Protector* explains the connections of water and our Earth systems. Simply put, healthy water means a healthy Earth. Author Winona LaDuke tells this story from the viewpoint of Algonquin mythology. The Ojibwe people of the Algonquin nation call a person who is a cannibal a Wiindigoo. The time of the Wiindigoo occurred during colonization of our country and Canada with the elimination of the Algonquin nation. In other words, we cannibalized their people and their land. LaDuke applies this concept to current practices that harm our water supplies. This harm might be through dam projects, pipelines, overfishing, ocean dumping, nuclear testing, or mining. One statement from the book that stuck with me was that there is more plastic in the ocean than fish.

LaDuke tells the back story of protecting our water is the basis for protecting our environment. Water is life, and our dependence on water is connected to all ecosystems.

Achieving the mission of the Water Protectors has been long and hard. Water

Protectors are an actual organized group, not just a name given to someone who cares but a concerted effort of a defined group of people.

The Algonquin are the best people to tell this story, as they have been here the longest and have the best knowledge of the history of the land. It is unfortunate that the new inhabitants are devastating their ecosystems and don't have the wisdom or knowledge of the Ojibwe nor are they willing to listen and learn from them.

LaDuke explains and gives examples of how we have failed to protect our water through examples of past and present legislation, poor decisions by judicial, legislative and executive branches and big business pushing through agendas regardless of the impact on the Earth and its water. The Water Protectors actively track, monitor and act through pen and physical protest as they see degradation of their precious resource. I was impressed with the depth and breadth of technical knowledge, philosophy, organization and planning of solutions to the problems and willingness to unselfishly

give of their time and energy to defend water resources. After reading this book, one can only admire the bravery and heroism of the Water Protectors in a David-and-Goliath situation.

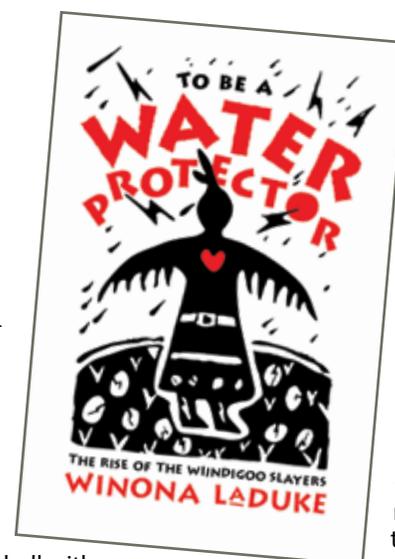
Possibly this rang a bell with me as I was reading the book while the Russian invasion of Ukraine was happening. A group of people who are standing up and defending their precious land, all be it for another reason, but the end result is the same, destruction, degradation, displacement and harm to people and the environment.

Summarizing the problem, LaDuke cites past intertribal agreements such as the Great Peace of Montreal or the One Dish One Spoon Treaty. This treaty demonstrates how to live together in peace with nature. A quote from the book, "Those ancestors recognized all people eat out of the single dish, that is, all hunting in the shared territory. One spoon

signifies that all peoples sharing the territory are expected to limit the game they take to leave enough for others and for the continued abundance and viability of the hunting grounds into the future." This statement is the Algonquin version of Tragedy of the Commons and certainly relates to the failure to protect our water supply.

LaDuke utilizes history, description of the problem and logical solutions which makes one appreciate what the Water Protectors do. You may even feel compelled to become part of solution personally by acting locally to protect our most precious resource.

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. ♻️



Funding Notice:

Community Geothermal Heating & Cooling Design and Deployment

Many thanks to our renewable heating section sponsor



The U.S. Department of Energy (DOE) announced the **Community Geothermal Heating and Cooling Design and Deployment Funding Opportunity Announcement (FOA)**, which will award \$300,000–\$13 million for projects that help communities design and deploy geothermal district heating and cooling systems, create related workforce training, and identify and address environmental justice concerns. The FOA will help expand community-scale geothermal by supporting new systems and developing case studies to be replicated throughout the country.

The FOA will support the formation of U.S.-based community coalitions that will develop, design, and install community geothermal heating and cooling systems that supply at least 25% of the community heating and cooling demand. Eligible applications must demonstrate that switching to geothermal district heating and cooling system would result in greenhouse gas emission reductions for the community where the system is installed.

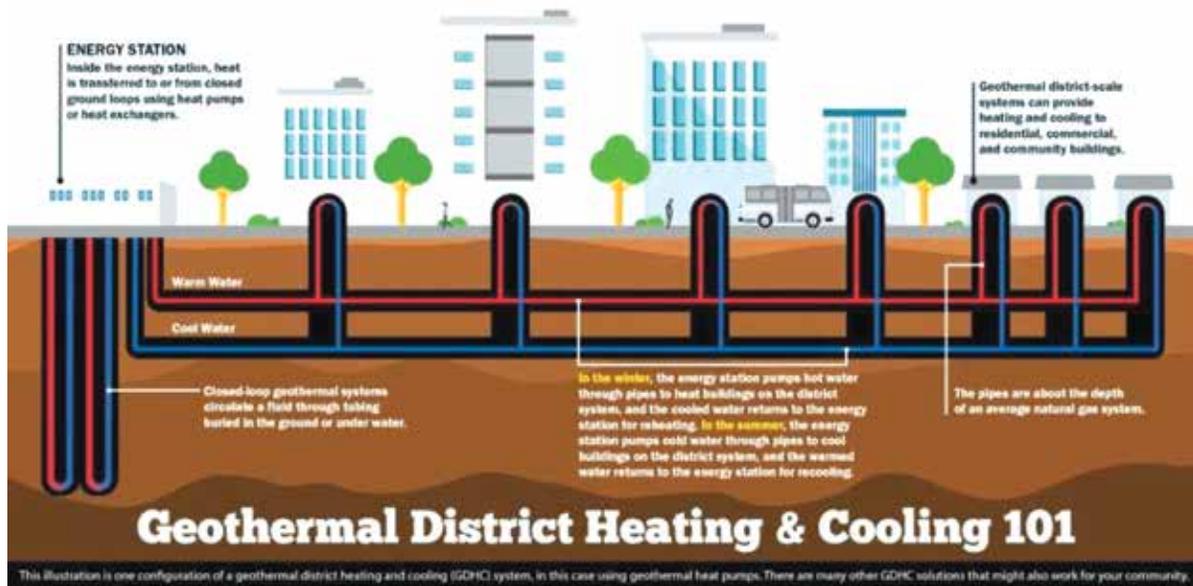
Widespread adoption of geothermal heating and cooling systems will help decarbonize the building and electricity sectors, reduce energy costs for families, and boost resilience. The FOA will also advance the objectives of DOE's Geothermal Technologies Office (GTO) to realize the potential of community-scale geothermal heating and cooling nationwide.

GTO anticipates making approximately one to 10 awards under the initial phase of this FOA, with individual awards varying between \$300,000 and \$750,000. In the second phase, GTO anticipates making one to four awards, with individual awards between \$2.5 million and \$10 million.

GTO seeks diverse teams to form U.S. community coalitions including representatives for four key roles: community voice, analysis and design, workforce, and deployment. Coalitions can be from urban, suburban, rural, remote, island, or islanded communities where geothermal can reduce dependence on fossil fuels such as natural gas or heating oil.

Applications are due by October 11, 2022 at 5:00 p.m. ET.

To assist coalition formation, GTO is providing a Teaming Partner List where interested parties can provide contact information and their expertise, which can be used by potential applicants or



entities interested in partnering with other applicants for this FOA. The list will be updated at least biweekly until the close of the full application period, to reflect new teaming partners who have provided their information.

Additional Information

- Download the full funding opportunity on the EERE Exchange website at <https://bit.ly/Community-Geo-Application>.

[Note: Beginning on or around August 5, all applicants will need to have a Login.gov account to access Exchange and ap-

ply to open opportunities.]

- Use the FOA Quick Guide as a reference to determine eligibility and how to apply.
- For FOA-specific support or questions, contact Community.Geo@ee.doe.gov.
- Sign up for GTO email notifications and the monthly Drill Down newsletter to stay current with the latest GTO news.
- Sign up for the Office of Energy Efficiency and Renewable Energy (EERE) funding emails and EERE news and the Weekly Jolt newsletter to get notified of new EERE funding opportunities and stay up to date on EERE news. ♻️



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Learn more at www.tacomfort.com



Forest Carbon Management Part II: Using Timber for Energy, Buildings, and Furniture and the Idea That Cutting Trees Is Bad for Climate Change

Charles Levesque

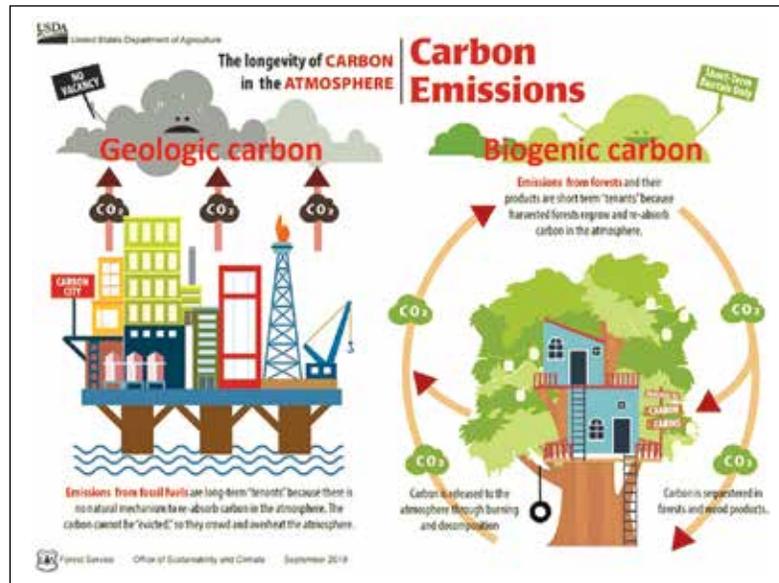
This is the second and final article in a series of exclusive *Green Energy Times* articles on some myths about climate change and the role trees and forests play in mitigating climate change's effects.

In the first article on forest carbon in the June 2022 issue of G.E.T., we discussed why not cutting trees in the northeast, where abundant forests are located, is not the best choice for addressing climate change. We talked about carbon sequestration – the act of trees taking in atmospheric carbon as part of photosynthesis. And we discussed carbon storage

in forests. Younger forests sequester more carbon per acre as compared to older forests. And older forests store more carbon per acre than young forests. This carbon represents carbon sequestration in the past.

And we also discussed the fact that if we don't harvest trees in the northeast where we have abundant timber - the most forested region in the U.S. and our forests are growing way more annually than we are harvesting. That uncut timber will be harvested somewhere

Figure 1 – Carbon cycles



else, because annual use of timber for all purposes is increasing year after year here, the U.S. and worldwide.

Wood for Energy

Using wood for energy has been somewhat controversial in the northeast in recent years. Some people who don't want to see trees cut say we should burn fossil fuels for energy instead of wood because they are more energy-dense than wood. The problem with that thinking is that fossil-fuel burning is the

main cause of human-induced climate change. Doing so brings geologic carbon from deep in the earth and releases it to the atmosphere for the first time, adding to what is already there. Using wood for energy is much more carbon and climate-friendly because it is within the biogenic cycle (Figure 1) where the carbon released from burning wood is then sequestered again by trees – and the cycle can continue over and over again without a net increase in the atmosphere as long as we are growing more wood and carbon than we are using. This is what we do in the northeast.

And burning it more efficiently, in modern wood heating appliances like woodstoves with catalytic converters and high efficiency firewood, wood pellet and woodchip boilers and furnaces, is essential to getting the most energy out of every cord of wood.

Timber as a Climate-Friendly Building Material

We have over 50 million acres of forest in the northeast region that includes the seven states of New England, and

New York. That's a lot of trees. Annually these forests, owned mostly by private individuals, families and companies, and some in public ownership, grow nearly twice the amount of timber removed from harvesting and land-use change. That means that the standing inventory of timber (and thus carbon since wood is half carbon) goes up every year, and this has been going on every year since the USDA Forest Service started keeping track of this data in the 1950s. Forest carbon in the region's forests has increased by 15% just since the year 2000! (Figure 2)

But because these forests are growing bigger and older over time, the annual sequestration rate – the amount of carbon sequestered per acre every year – has actually decreased over time. Younger forests sequester more per area than older forests. If you were standing in a forest where most of the trees are about six to eight inches in diameter, that would be the age forest that is sequestering the most carbon each year. Older forests, however, store more carbon per area because the trees are bigger.

An added benefit in the northeast U.S. is that when we harvest trees here – just a small portion of what grows each year – we are blessed because they grow back naturally – we don't have to plant them. This is because our soils, climate and trees species naturally produce seed or sprouting from

Cont'd on p.27



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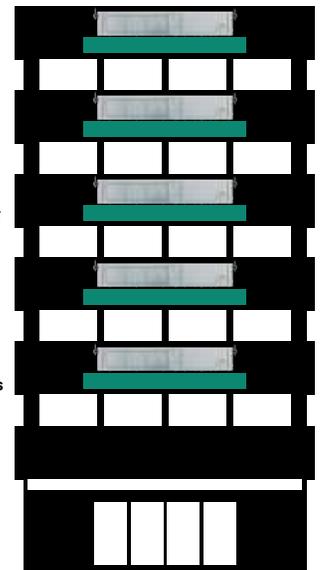
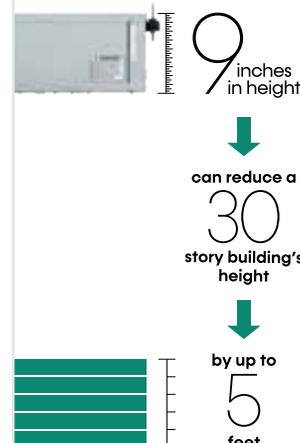


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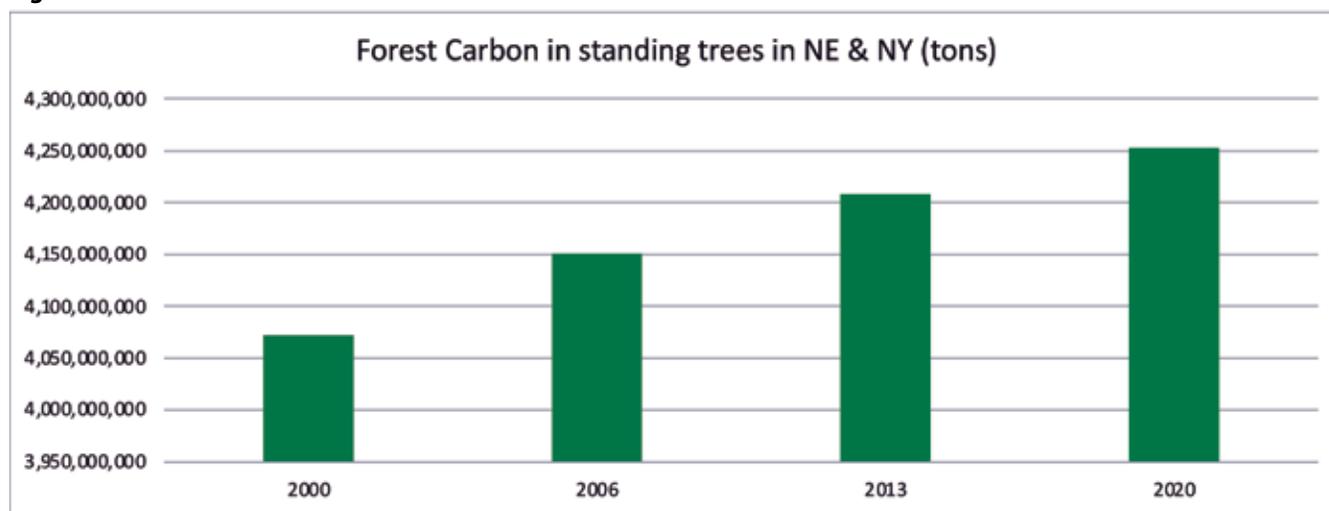
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Figure 2



USDA Forest Service, Evaluator 2.0.3

< Cont'd from p.26

stumps to regrow our forests. A key part of a forester's job is to design harvests in such a way to quickly and naturally regenerate the forest.

Wood has been used as a building material for millennia. And it has been used for furniture that long, too. When Europeans and others colonized the northeast, wood was, for the most part, their only building material. First, as log homes, and later as timber frame structures, and more recently as "stick-built" structures using two-by-fours and other structural sizes as the frame and other wood materials for sheathing and roof. We still do that today in the northeast, but in commercial buildings, the increased use of concrete and steel as the main building materials has increased dramatically over the last 100 years or so. But these buildings are not climate-friendly. Cement production is one of the leading worldwide sources of greenhouse gas emissions and steel production is very carbon intensive.

Using wood as the main building product is much more climate-friendly and less carbon intensive than steel and concrete. And when solid wood is placed in buildings, this serves as long-term storage of carbon so it is not released into the atmosphere. A comparison of three floor designs for buildings (Edmunds and Lippke 2004) shows that a full wood floor is five times less carbon intensive to make and install compared to steel floor designs and almost three times less carbon intensive than a concrete slab floor (Figure 3). Plus, the wood floor stores carbon for a long period of time.

Timber and wood products made from trees are ubiquitous in the northeast, and the forest products infrastructure (foresters, loggers, truckers, sawmills, etc.) is very robust. Increasing wood use for building construction is entirely plausible as part of our climate solution while having our forests serve as carbon sinks as they grow. The increase in lumber prices you may have heard about recently has been due to the pandemic's effects on the economy and the supply chain for lumber. Lumber prices have already started to drop down to pre-pandemic levels.

A fantastic movement, begun in Western Europe 20 years ago or so is called "mass timber." Mass timber is a building technique coined to describe the use of

solid glulam beams (stacked and glued structural lumber) and cross-laminated timber (CLT) to build tall buildings – now up to 18 stories tall with a new building code being adopted around this country. CLT is structural lumber glued into huge panels (see Woodworks for more info on mass timber at www.woodworks.org).

Mass timber buildings replace the customary use of steel and concrete as the main building components and the result is a much more carbon-friendly building – by leaps and bounds – and also provides for the long-term storage of carbon in the wood in the buildings (Figure 4). Lastly, these buildings are simply beautiful – aesthetically warm and pleasing compared to



Mass timber apartment building

In the northeast U.S., we have laws and regulations to assure that timber harvesting is done in an environmentally sound manner. If we don't harvest trees here, they will be harvested elsewhere – and maybe in parts of the world with less resilient forests like the rainforests of South America or in places where harvesting is not done in an environ-

mentally-friendly way. This would not be better for the planet.

So, the key point here is that using wood products made from trees in northeastern forests is a very environmentally and carbon-friendly practice. Not harvesting timber here, but continuing to use it for building and energy just pushes the demand for forest products to other forest harvesting elsewhere and does not result in an improvement in our global climate change situation.

Links provided in the online posting of this article at greenenergy-times.org.

Charles Levesque is President of Innovative Natural Resource Solutions, LLC – a northeastern U.S.-based consulting firm. He also serves as

Executive Director of the Northeast State Foresters Association and is Coordinator of the new Securing Northeast Forest Carbon Program. He can be reached at levesque@inrslc.com or 603-588-3272.

Consumption of Fossil Fuels (MJ/ft² of supported floor) Associated with Three Floor Designs

	Floor Design		
	Dimension wood joist floor	Concrete slab floor	Steel joist floor
Fossil Fuels (MJ/ft ²)	9.93	24.75	48.32

Source: Edmunds and Lippke 2004

steel and concrete.

This kind of building technique can also be used on smaller buildings or as part of a hybrid where CLT floors are used in a conventionally-built wood building. All of it points to more use of wood in buildings, less use of steel and concrete, with multiple benefits for the planet and for the forests of the northeast.

Leakage

We discussed the leakage issue in our earlier article, but it is so important that we need to quickly cover it again here. Simple thinking says if we don't cut trees then the planet will be better off because trees sequester carbon. The problem with that thinking is the issue of leakage. Leakage from a forest carbon perspective is that if you don't harvest a tree here for products, it will be harvested somewhere else because demand for wood products is increasing in our region, the country and the world. It is naïve to think that if we stop harvesting a tree on a property or in our region that there are only positive climate effects.

Many thanks to INRS for their article contribution to our Forest Management series.



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HEAT LOCALLY – Cont'd from p.21

Bourne's Energy is the exclusive dealer of bulk wood pellets for the Vermont Wood Pellet Company. Jim Kurrle Senior Manager at Bourne's Energy specializing in renewable fuels states, "Our relationship with Vermont Wood Pellet Company is one we are particularly proud of because of the direct impact it has on Vermont and our environment. The entire chain for this product line is Vermont made. The wood is harvested in Vermont, by Vermont loggers and Vermont truckers. Pellets are made by Vermont Wood Pellet Company in North Clarendon before making their way to Bourne's Energy's dedicated pellet facility in North Hyde Park. Our company has a 75-year history rooted here in Vermont and is still owned and operated by the Bourne's family. Our team is all local, which means your pellets are delivered to you by someone who could well be your neighbor. It's a complete circle serving Vermont every step of the way."

Bourne's Energy offers bagged and bulk pellets and delivers bagged pellets throughout Northern and Central Vermont and bulk pellets across the entire state. Pellets can also be picked up at 87 Main St. Barre, VT. In addition to pellets, Bourne's Energy also offers bulk pellet storage bins with options for indoor and outdoor storage. A program through the Renewable Energy Resource Center offers customers purchasing a new pellet storage bin a voucher that will cover up to \$3,000 or 85%, whichever is less, of the total bin and materials cost. Bourne Energy has a number of outlets in Vermont. Their website is bournesenergy.com.

Now is the best time of the year to purchase wood pellets. We advise readers to start their search for suppliers by contacting reliable companies that are near their homes.

Securing Northeast Forest Carbon Program is an effort by the state governments in the seven-state New England and New York region to educate about forest carbon and the role trees and forests play in combatting climate change. A clearinghouse of information on forest carbon is at the Program website at www.northeastforestcarbon.org.

Williams College Takes a Crash Course in Window Weatherization

Christopher Pratt



The heat that builds each year from carbon emissions is also turning up the heat on sustainability directors and project managers of New England colleges to decarbonize their respective campuses by a 2030 deadline, or else. So, when it came time to decide what to do with some enormous 1912 12-by-12-foot double hung windows at Thompson Science Center at Williams College in Williamstown, MA, sustainability project manager, Doug Schlaefer made an unusual decision. He called up a little window weatherization company in Montpelier, VT named Open Sash, to see if they could weatherize seven of the building's windows. The work would be a pilot project that could lead to a blueprint for treating all the old windows on campus, if it was successful.

As the owner of Open Sash, I was thrilled to get Doug's call back in the winter of 2021. I had always thought campuses like Yale University, Middlebury College and Williams College should use my window weatherization treatment, but never got a foot in the door or window, even as an alumnus of Middlebury and Yale. In fairness to my alma maters, I have not had a lot of time for networking and outreach. I spend my time working and looking for other people to also do the work. On the other hand, they could have read my article in the NESEA 2021 Quarterly Magazine, Winter edition and called, as Doug had.

Big, beautiful, divided lite windows are a challenge when it comes to decarbonizing a building. They are the eyes and soul of these historic campus buildings and as such are impossible to replicate with modern

factory-made windows. More important, the exorbitant cost and carbon-emission life cycles of replacement windows make them a poor choice in the long run. Once you are on the "conveyor belt" of replacement windows, you are then looking at a potential replacement cycle of every 25 to 30 years.

The Open Sash system adds a low-e panel of glass to the outside of the sash, such that it can move up and down freely with the sash. The old window is unchanged and the efficiency is increased 80-90% compared to that of a replacement window. Most important, it is repairable and has a much lower carbon-emission life cycle, which is really the goal of building decarbonization. There is also the option to add an exterior storm window, but they are lacking in efficiency, aesthetics, usability and their carbon life-cycle emissions are higher than the Open Sash Method. Williams had added storm windows years earlier but will now consider removing them, as one less component to maintain. Doug said, "We hope the work to redo the windows will result in less draft complaints and greater comfort in the space."

I wasn't able to replace the windows at Williams myself due to labor shortages, especially in the trades, so we opted to squeeze in a training for the Williams trade staff and a local contractor.



Williams College in Williamstown, MA. (Doug Schlaefer)
Above: Williams facilities technician, Jason making a deal cut on a bottom rail assisted by Kyle and then smoothing the cut with a sander. (Chris Pratt)

Williams College Facilities Department is also shorthanded, but they had the tools, space and, most important, enough skilled labor to get the job done. I was happy and able to spend four days training them in my method and passing on the knowledge to as many people who are interested. In my twelve years of running this business, I have taught many new hires how to work on windows, but I have never had a chance to work with such a great group of four experienced and skilled woodworkers. My experiences suggested that it would take a couple of years to train new employees but working at Williams made me realize that this period could be much shorter.

In just four days of teaching and working with the four carpenters, we were able to remove, weatherize and re-install the seven enormous windows. A good deal of the time was spent moving the windows through a labyrinth of corridors, stairs, and elevators. This was an impressive accomplishment and bodes well for the future of old windows and decarbonization of college campuses around New England. We hope other colleges will follow suit and consider this option as a means to reduce emissions, but also allow them to extend the useful life of their older, existing window stock. That is good, because the heat is on to get this work done soon.

Christopher Pratt is the owner and founder of Open Sash Windows. He lives in Montpelier and focuses on the repair of windows for improved efficiency throughout central Vermont. Learn more about his work at OpenSash.com.

Watch for an upcoming interview with Pratt for further details about his methods. ♻️

Wind Energy Training – Cont'd from p.15

wind energy construction may resume if legislation is adjusted to make permitting a little easier.

What we teach in our wind energy class is a mixture of design and site development. We start with the study and measurement of the wind. Some math is needed to accurately describe the variations of wind speed that occur as a function of altitude, and the variations as a function of time due to turbulence. We measure wind speed with instruments on our 100 ft anemometer tower. This tower has been in service for many years, and this year we are lowering it down for an overhaul. Anchors and cables will be inspected, and the students will replace the instruments. Once the systems have been checked, the tower will be raised again. AllEarthRenewables has offered to help with the safe raising and lowering of the tower. Once the instruments are working, the students learn how to download the data for further analysis and checking.

As engineers, our students know how to build structures and analyze them to make sure they will stand up to the loads. Basic strength calculations are done on towers and bolted joints. They also do some aero-

dynamic design of wind turbine blades.

Students learn how to take data to determine the power curve of a wind turbine. The power curve shows how much power the turbine will produce as a function of the wind speed. Students learn how to make adjustments for altitude and temperature to standardize data. Raw data from wind turbines connected to Wind for Schools OpenEI is used in this process.

Wind turbines, like other sources of energy, have impacts, and research into impacts is part of any good development process. Students learn the visual, noise, water, and ecological impact of wind development. Noise calculations are an aspect of the class that is very math-intensive. Wind turbines also affect each other. Given limited land available for development, students need to understand how the wind is reduced in the area downwind of the turbine and predict the energy production for any given group of wind turbines.

Renewable energy is a business, and like all businesses the costs and revenues need to be analyzed. The cost-effectiveness of wind is very sensitive to the wind resource. Students in our program take several busi-

ness classes so they know how to calculate and present cash flow and break-even point for projects.

The final project in this class usually consists of a development plan for a wind turbine or group of wind turbines. Some students do a project plan for a wind turbine net-metering project for their high school. Others look at feasibility of wind turbines for coastal Alaska or Caribbean islands.

VTC offers two- and four-year degrees in several engineering disciplines, but we also support apprenticeship and certificate programs. Our Office of Continuing Education and Workforce Development (CEWD) coordinates these career-focused classes. We offer Green Trainings in HVAC, Indoor Air Quality, and Building Performance Institute (BPI) training. In the past we have offered a solar PV class, and we are hoping to offer it again soon. As the climate workforce expands to meet the need, our certification programs can expand as well.

Daniel Costin works at Vermont Technical College as an Assistant Professor – Mechanical & Manufacturing Engineering Technology and Renewable Energy Program Chair. ♻️



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Save Energy and Stay Warm This Fall with These Window Installation Tips

Jeff Barsalou

Buying new energy-efficient windows is an exciting time. Whether you're doing it to reduce the energy bill, enjoy comfortable, consistent home temperature, or hear less noise from the outdoors, the benefits are worth the upgrade. Simply buying the windows, however, is not enough on its own. Correctly installing them is the only way to experience the full benefits.

Reducing the energy consumed for heating and cooling is the number one reason for choosing higher efficiency windows. The payback period is between seven and twenty years. This depends on the building, lesser performing alternative, and the new windows being installed.

Another benefit of new windows is to minimize road and neighbor noise in the house. Sound transmission is measured either with the Sound Transmission Class (STC) rating or the Outdoor/Indoor Sound Transmission Class (OITC). Either way, the higher the number, the better the sound-blocking capabilities.

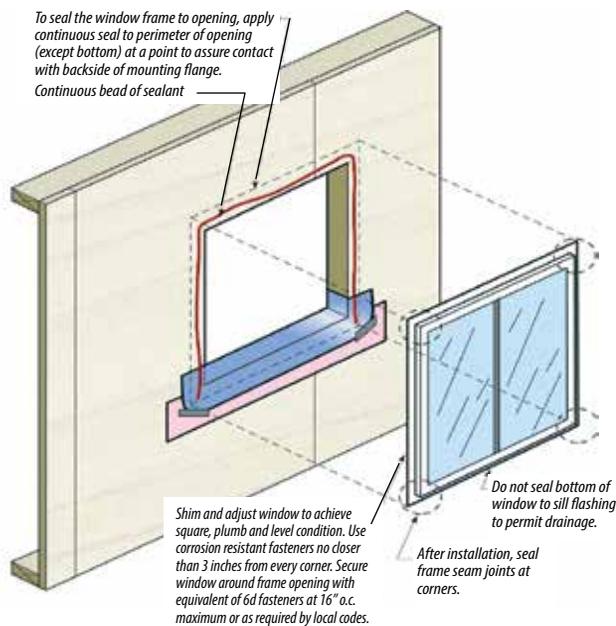
Another thing to consider is window performance levels. Besides the various insulation levels of double- and triple-pane units, the best windows also pass performance criteria discovered by independent testing.

Good windows improve the water resistance of your home's building envelope and can enhance the appearance of the entire house, too. LoE coatings on window glass reduce the energy lost by radiation, and argon gas between panes improves the overall R-value of the whole glazing unit.



PHIUS-certified casement and fixed windows in a modern Passive House designed home. (Images: Kohltech Windows & Entrance Systems)

Window installation best practices diagram



Divided lites and grilles are a significant visual window feature, especially with older homes. They can add a lot, but may not be the desired look you want when replacing. Newer window styles trend towards more glass, so when replacing units it is a great time to remove or omit features such as divided lites or grilles.

How you plan to install your windows can be a powerful part performance and it is crucial that it is done with care. Even if you know the steps and technical details like the back of your hand, always review a detailed installation procedure from the manufacturer, which should include the following points.

- Use caulking to seal the window mounting flange to the

exterior surface of the building wrap if it's visible. This caulking is part of the seal you need to create, but you still need exterior flashing.

- Use low-expansion spray foam around windows. This particular type of foam helps ensure window frames don't bow inwards, allowing operable windows to be opened and closed easily.
- Install temporary props to support window and door jambs against bowing inward. These props are in addition to the application of gentle foam. Wooden props cut to fit opposite sides of the window jamb ensure that foam expansion poses no problem.
- Always use flashing. Never rely only on the window installation flange for waterproofing a window installation. (Flanges are for anchoring only, and while they keep out some water, flanges alone are not enough for a reliably dry installation.) Instead, use self-sticking or metal flashing. Install the flashing over the top of a window so it overlaps the flashing on the sides. This side flashing must overlap the bottom flashing, so the whole installation sheds water.
- Install a plastic drainage pan. This pan is cheap insurance against window leakage. Drainage pans are sloped plastic devices made to sit underneath a

window unit in the rough frame. If leaks get past the windows, the sloped drainage pan directs the water out of the building harmlessly.

- Lap any building wrap over window openings, so all the layers shed water.
- Install support shims at all four corners of a window frame and every twelve inches along the bottom. Always use shims in pairs to provide full support under the window frame. They can be plastic or wood that won't fall apart if shims get wet.

New windows are a significant investment and you should consult professionals to help make wise purchasing and installation decisions.

Jeff Barsalou is the Marketing Manager and U.S. Business Development Manager for Kohltech Windows & Entrance Systems. Kohltech recently celebrated 40 years of vinyl window manufacturing. ♻️



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Getting Serious About Weatherization

Weatherization Assistance Programs in Northern New England

By Michael Daley
and the G.E.T. Team

The recent Bipartisan Infrastructure Law authorizes the spending of \$3.5 billion on weatherization, a roughly 6% increase over previous levels. These funds will have a positive impact on state programs in our region to button up homes and fight climate change. Coupled with the grim windfall from COVID assistance through the American Recovery Act, states are taking this opportunity not only to expand weatherization funding but to move from the traditional focus on low-income families to include moderate-income people as well. For example, according to the Maine Jobs and Recovery plan, Governor Mills proposed an additional \$50 million investment in energy efficiency and home weatherization. In Vermont, bills were introduced to double the pace of home weatherization – a \$129 million yearly investment that includes middle income families in the program for the first time.

The United States has had an effective building-weatherization assistance program since the Great Society of the Johnson Administration of the 1960s. The program is often referred to as “WAP” (https://bit.ly/Energy_gov_WAP). The program’s purpose is to reduce the energy



Air sealing keeps the cold air out in winter and cool air in in summer. It makes your heater burn less fuel and your air conditioners work easier. It is one of the fundamental steps of weatherization. (Community Environmental Center/Flickr)

costs for low-income families by increasing the energy efficiency of their homes. The necessary weatherization evaluations and remediation activities are provided at no cost, or extremely reduced costs. In most cases heating or cooling needs are reduced by at least 30%, resulting in about \$300 in typical annual savings. WAP is available to income-eligible homeowners, businesses, renters, landlords, municipalities, schools and other public qualified buildings, though this can vary somewhat by states.

According to LIHEAP (<https://liheapch.acf.hhs.gov/>), the official information

clearinghouse for the WAP, since 1977 the federal government has spent an average \$300 million per year subsidizing weatherization for low-income families. About 35,000 homes per year were weatherized, benefitting over 7 million families. Seems impressive, yet that represents just 2% of all eligible households.

WAP is structured with federal funding grants allocated to the states which then administer and deliver weatherization services to their citizens. The states in turn delegate these programs principally to Community Action Agencies (CAPS) which typically cover large regional territories and deliver a wide range of public assistance programs. For those interested in a global picture of the WAP program, visit this website: Weatherization Assistance Program | Department of Energy.

Organizations performing weatherization cover most if not all of G.E.T.’s areas of circulation in Vermont, New Hampshire, New York and Maine. Vermont has five regional agencies, and four of them operate under or within CAP agencies, one is independent. In New Hampshire there are six agencies; among them a sizable one covering all of Coos, Grafton, and Carrol Counties, which together comprise most of the northern area of the state.

Services are rendered to income-eligible homeowners, occupying most types of homes one might think of, including “stick built,” mobile homes, and manufactured homes. WAPs also join in efforts to assist multi-family housing development (renovation or new construction), often working hand-in-hand with general contractors performing the majority of any

given project. Vermont has been particularly successful in making these arrangements work. At least some regional WAP activities are done through landlords for the benefit of tenants.

Whether the weatherization work is to be done for the benefit of homeowners, project developers, landlords, or whomever, there is an application process that varies depending on the type of beneficiary or recipient of the work. Rather than attempt to cover this topic here completely, we suggest you contact your regional agency for current information, including facts about, and criteria for, income-eligibility and related factors.

How do you find which agency serves your area and if you are eligible for assistance? G.E.T. found that visiting the primary state website for the WAP provided the necessary information and links to the area agencies quite efficiently. Across the board, from federal to all state websites, the weatherization navigation pathways were clear and simple – quite a nice discovery. A complete listing of each state’s primary access point follows:

Maine Weatherization Assistance Program: https://bit.ly/Maine_WAP
New Hampshire Department of Energy Weatherization Assistance Program: https://bit.ly/NewHampshire_WAP
Vermont Department of Children and Families Weatherization Assistance Program: <https://dcf.vermont.gov/benefits/weatherization>

New York State Weatherization Assistance Program: https://bit.ly/Vermont_WAP

A note for non-income-eligible parties: Some regional agencies provide assistance on a fee-for-service basis to non-income-eligible homeowners, tenants, or

Cont’d on p.34

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A BUNCH OF B.S.* (*BUILDING SCIENCE, OF COURSE!)

WORTH A THOUSAND WORDS: AN IR IMAGE WITH A LOT TO SAY

Nate Gusakov, BECxP

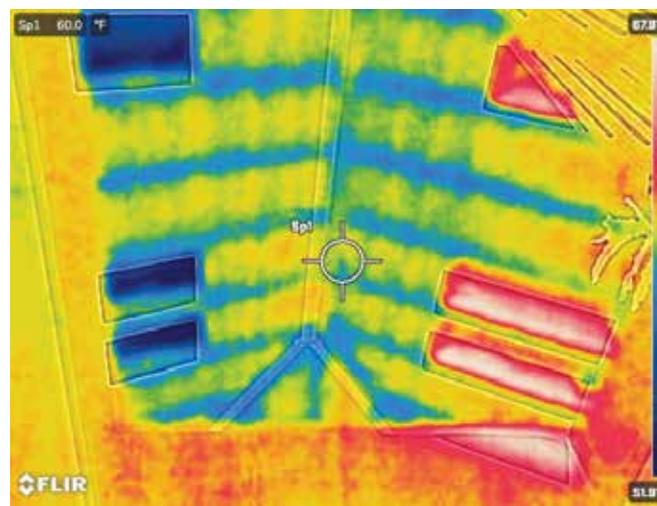
Take a look at the IR image that goes along with this article (and its similar but visible light image). Both were taken at the same time (about 11:30AM) by different lenses on the same camera. When I took the pictures, I was in an office building in Middlebury, VT looking up at a vaulted ceiling with skylights on both sides of the ridge. Obviously, there's more going on than meets the visible-spectrum eye. Let's explain it.

First, what exactly is an IR image? IR stands for infra-red. 'Infra' means below or beyond, and 'red' means, um, red. So, it's a 'below-red' image? Exactly. Electromagnetic radiation is detectable by different receptors at different wavelengths. For example, UV light's wavelengths are just barely too short for us humans to see, but as we move down the vibrational spectrum the waves grow in length, vibrations get slower, and our eyes perceive a backwards rainbow of visible light: violet, blue, green, yellow, orange, red...hmmm, what's below the frequency of red light? Infrared, indeed.

Now, what is the most common way we perceive electromagnetic radiation in the IR spectrum? As heat. Our nervous system can perceive IR radiation directly, right through our skin. It's helpful enough to keep us a safe distance from a fire or know when it's too cold to be outside without a jacket, but our own IR perception isn't nearly sensitive enough to map out detailed, subtle differences in radiation patterns on a surface 20 feet away. For that you need an IR camera, which has a non-glass lens (usually made of Germanium, because glass will block

heat and would be about as good as a lens cap in this case) and a crazy system of micro-mirrored 'pits' behind it. These pits direct wave/photons of incoming IR radiation down towards a very special receiving element at the bottom (one 'pit' equals one pixel). This receiving element (usually vanadium oxide or amorphous silicon, if you care) generates an electrical charge relative to the intensity of the IR radiation it's receiving, and a 'picture' of the surface temperature of things can be created.

OK good, now that we're all up to speed on how this picture gets made, let's dive into what it tells us. For reference, the narrow color bar on the left side of the IR image shows how the image colors relate to temperature, going from coldest at the bottom (dark blue, ~52 F in this image) to warmest at the top (red/white, ~68 F).



IR image and its twin visible light image. Both were taken at the same time in an office building looking up at a vaulted ceiling with skylights on both sides of the ridge. (Nate Gusakov).

So, what can we see?

1. It's at least somewhat cold outside, and there is no thermal break above or below the roof rafters. The rafters (the green rib-like pattern in the IR image) are acting as thermal bridges, drawing heat from the room directly through the sheetrock and across their wooden bodies to the roof, which must be relatively cold if it's continuing to cool the room via the rafters at mid-day. Even a fairly thin layer of continuous insulation (often rigid foam, in an application like this) on the top or bottom side of the rafters would create a thermal break and make the rafter pattern disappear from the thermal image (which would mean that less heat is being lost to the outside).

2. The spaces between the rafters do a better job of insulating than the rafters themselves. The ceiling surface is warmer between the rafters, so there must be something in there that has a higher R-value than wood framing. This is good.

3. The ridge of the building runs north-south. The difference in temperature between the surfaces of the skylight wells on the right (bright red) versus the left (deep blue) is striking! In this case, it's all about angle of incidence. This is the angle at which sunlight strikes a surface. If the sunlight is striking more or less perpendicular to a surface (high angle of incidence), the full force of its radiation is absorbed as directly as possible. In this picture, the skylight wells on the right slope towards the east and at that time of day are receiving much more heat energy than they are releasing. If the sunlight strikes at a slant or askew against a surface, the amount of IR radiation absorbed by that surface is significantly less. In this case, the sun is still shining on the left (west-facing) skylights, but it is striking them at a very low angle of incidence, so they are gaining less IR radiation than they lose.

There it is—much can be learned from an IR image. Maybe not quite 1000 whole words for this particular picture, but pretty close anyhow. Now I have to find some fresh germanium; my stash is running low.

Nate Gusakov is a building enclosure consultant at Zone 6 Energy and Silver Maple Construction. He aspires to be like Friar Tuck in the Sherwood Forest of modern building science. ♻️

ONLOGIC GLOBAL HEADQUARTERS – Cont'd from p.18

issues which caused us to explore alternate sites and finally led us to Technology Park and ReArch. We were ecstatic for an opportunity to join the Technology Park community. We feel it will be a great location for growing our global technology company, and it came with the benefit of working with the ReArch Construction Company. We selected ReArch for their strong reputation in our region. Their team has been excellent to work with.

G.E.T.: Are the EV charging stations meant to accommodate vehicles already in use by your employees or to encourage them to buy EVs in the

future (or both)?

OnLogic: Both!

G.E.T.: Is the power for these chargers coming from the building array or another source?

OnLogic: The design is flexible to work with either.

G.E.T.: Your company is growing fast and the press release states this new building will be adequate for the next seven to ten years. Sustainability is also about longevity and adaptability of use. Did the design team envision what this building might be used for in the future if OnLogic moves on?

OnLogic: Future flexibility has driven much of our decision making. We were intentional about how we designed spaces, selected finishes, and incorporated features to satisfy our current needs, our possible future needs, and even hypothetical future tenant(s) or other owners. The overall design enables many options for future expansion and conversion of spaces.

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

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AN EFFICIENCY REMODEL IN MAINE SHOWS THE WAY

Barb and Greg Whitchurch

Is it hard to keep your home comfortably cool when it's very hot outside? Cozy warm when it's very cold outside? Is it expensive to run your house in these conditions? Do you have extra machines (fans, air conditioners, space heaters) working to relieve your temperature discomforts?

Or, are you concerned about your home's contributions to the climate crisis and pollution-caused health problems because of the fuels you use or the amounts? What about your home's vulnerabilities to the climate crisis extreme weather? Its equity value?

Almost all recent and older homes would benefit greatly from air tightening, window upgrades, more insulation, and better mechanical systems (heating, cooling, ventilating). Beyond the obvious and immediate comfort and health improvements, these changes also save a lot of money while reducing the inflammatory effects on our weather and climate from wasteful leaks and losses.

Beyond weatherization is the Deep Energy Retrofit (DER), where the foundation, outside walls, windows and roof are all addressed. Centuries-old farmhouses and homes built earlier this century are undergoing DERs.

Fortunately, about 20 years ago the engineering standard called Passive House (PH) accomplished the Holy Grail of building design and construction: namely, sweet-spot targeting of comfort, health, energy use, simplicity, and price-point cost-effectiveness across all types of buildings. This development has shone a spotlight on the weaknesses of standard construction practices (bit.do/get-house-part2).

So, PH DERs are all the rage now, with the major benefits going toward the occupants, utility bills and the environment. Whether one ends up with the formal PH Certification plaque or whether they've made it most of the way but had to come up a little short for some reason or other, following the PH path results in a pleasing and finally permanent solution. A DER



Martha and Jesper's finished deep energy retrofit from the back. Notice the Mitsubishi mini-split at the far right. (Images: the Whitchurches)

doesn't just bring your home up to date, it's more like finishing it, finally! And, just like with electric cars, maintenance is minimal to none, especially when compared to what one started with.

Martha McLean, a Spanish teacher now turned private attorney, and her husband, Jesper Kruse, built their own home in 2000 in Greenwood, Maine. Jesper, originally of Denmark, had been working as a carpenter for about three years, and while he worked with a construction company and she as a teacher, they built their home in their spare time: Six-inch cellulose-filled walls, insulation board under concrete slab, 16-inch cellulose in the attic, nicely designed – quite an accomplishment. But over the years they came to realize that they came up short, comfort- and efficiency-wise; and when their Brosco wood windows began to fail after a dozen years, they slowly and incrementally came to realize that replacing those windows really should be the catalyst for addressing shortcomings in the entire envelope. Hence, a DER was born!

Now, the details of how they did their DER are beyond the scope of this article. Our intention here is to pique your interest enough that you would consider such an effort to improve your own life by vastly improving your home. ALL of the details of their efforts as well as all the references

you'd need to seriously consider such an effort are right here in the links.

Very briefly, they dug down along the foundation and added 10 inches of EPS foam against the concrete (this broke the thermal bridge from the slab which has only two inches of XPS, but is unaddressable); they sealed an air barrier/moisture control membrane against the concrete and brought it up the outside walls to the roof; they added another 10 inches of cellulose between

two-foot-on-center TJIs on the outside walls which already had six inches; they brought the wall membrane up over the roof and extended the eave to cover the widened walls; they placed a variable vapor permeable membrane over the 16 inches of cellulose already in the attic. An in-depth review of their process is here: bit.ly/pha-jesper and bit.ly/475-jesper.

We also want to make it clear that taking a less serious path than PH toward improvements doesn't serve your interests now or in the future, because somewhere down the road you or someone else will be

facing the unmet needs left over from yet another shortfall. Don't make that mistake!

Jesper suggests reaching out to organizations like www.PassivHausMaine.org or www.phius.org/ if you're looking for resources. There are PH organizations in every Northeastern state, and they are there to help YOU with your dreams and needs. There are many architects, designers and builders in every state fully certified to build to the PH standard -- although there are also lots of old-timey, business-as-usual pros stuck in the past who'll try to talk you out of anything beyond what they already know. In fact, most homes under construction right now will be weatherization candidates as soon as the new owners move in.

Some states have energy efficiency utilities (paid for with tax dollars and utility bills) like Efficiency Vermont to provide free consulting services and monetary rebates for such projects. Jesper, like we and many others, also consulted with 475 Building Supply for advice and materials.

If you get in touch with a PH-certified professional, they'll inform you of the financing, rebates and other incentives aimed at businesses which build responsibly. There are specialized low-interest "green loans" for such projects.

Most of the effort and money for Martha and Jesper's DER went into aspects that can't be seen in the finished product except for smiles and sighs of relief from the family. Very little was done to the inside of the home. They replaced wasteful and costly mechanicals with a Whirlpool condensing dryer, heat pump water heater, a Mitsubishi

cold climate heat pump mini-split for heating and cooling, a direct vent for their Morsø woodstove, and Lunos HRV ventilators. Upgrades to the cooking and fridge, new floors, etc. will be done with their considerable energy savings.

Again, they didn't get all the way to PH but by taking the PH road they did maximize their opportunities and got the most bang for their bucks. It's a new home in the most important ways, yet so familiar. And they're DONE!

The Whitchurches use induction cooking in their Net Zero+ Middlesex, VT Passive House, bit.ly/vtph-phc. bit.do/gkw-li 



Martha and Jesper's finished deep energy retrofit



©passivehouseaccelerator.com (NASA)

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Elm Place, Milton Vt (Carolyn Bates)

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Warm and Cool Homes

Part Three: The Burns' Straw Bale Home

Wes Golomb

This is the third in a series of articles based on Wes Golomb's newly published book and video series, *Warm and Cool Homes, Building a Comfy, Healthy, Net-Zero Home You'll Want to Live in Forever*. The book is a look at five high performance homes, four of them net-zero, and the techniques and technologies used to build them.

Andrea and Jeff Burns built their nearly net-zero home before most people even conceived of the idea. Built from local materials, heated with wood and passive solar, and powered by 1.2 kW of photovoltaic energy, their off-the-grid home provides sufficient heat and hot water and a good portion of their food.

Andrea and Jeff Burns live deliberately. They value connection with the land and wanted to build a home with local, non-toxic materials. They desire to live as sustainably as possible and choose which technologies to incorporate into their home. They planned the house to be off the grid for economic and political reasons. Installing a PV system was the same cost as running power lines from the grid. Jeff opposed the building of the Seabrook nuclear power plant beginning in 1976 and vowed to not use electricity from, or pay for, the plant. Today, three decades after the Public Service Company of New Hampshire went bankrupt, Jeff and his family live off the grid while the rest of the state continues to pay off this boondoggle every month. When the price came down, they added more panels which charged their batteries faster.

The Burns' 2,000 square-foot home is built with straw bales which has been a common building material in the southwestern United States but remain fairly unusual in rural New Hampshire. The Burns family liked the idea of building with straw bales because they are renewable, non-toxic, and have a high R-value.

The main section of the home uses oat straw grown on Tom Abbott's farm just a few miles from the building site, while the addition was built using rye straw grown in Claremont, New Hampshire.



The Burns' straw-bale home (Andrea Burns). Rt: the interior of the Burns' home. The passive solar design helps to heat the house in winter and shade it in the summer. (Wes Golomb)



Andrea was quick to answer the three most common questions about straw-bale homes.

First, what about fire?

Straw bales are tightly bound and five times more fire retardant than wood. While building the house, we threw a bale of straw into a bonfire. The next morning, when the fire was out, a singed bale of hay was left in the fire pit.

Second, what about animals?

Straw bales contain no food and are packed so tightly that there is no place for animals to reside.

Third, what about rot or decay?

The bales are coated with plaster, which keeps them dry. The plaster is made from clay, sand, water, and chopped straw to provide strength. The final coat contains lime and sand, which makes it waterproof. The plaster also serves as an effective air barrier and has the wonderful property of wicking any moisture out of the bales. During a recent remodeling project, we opened

several bales of straw and saw no signs of decay.

Passive Solar Design

This home incorporates passive solar design features including windows to the south, thermal mass, and a roof overhang. In the winter, when the leaves fall from the trees and the sun is lower in the sky, sunlight streams deep into the house, warming the air and heating the thermal mass.

In the summer, when the

sun is high, the overhang shades the inside of the house. In the winter, the window treatments are lowered to keep heat in. The thermal mass radiates the stored heat and the well-insulated and air-sealed shell holds the heat, and, as the house slowly cools, the thermal mass radiates its stored heat into the home, keeping it warm.

The wood stove also supplies hot water. Cold water is run through a heat exchanger in the flue and then transferred to an insulated storage tank for radiant heat and domestic hot water.

The Burns elected to use standard double-pane windows with insulated quilts. They open the quilts in the morning and close them at night. This effectively limits heat loss on cold nights.

In the summer Andrea reports that

people have come into the house and proclaimed, "I didn't know you could air condition an off-the-grid house." In fact, there is no air conditioner. Rather, the combination of insulated windows and a well-insulated, air-sealed shell keeps the house comfortably cool in summer and warm in winter.

All the electricity for this house is provided by a small photovoltaic system (1.2 kW) and a backup generator, which uses about 100 gallons of gasoline a year (this is the only fossil fuel used by this nearly net-zero home).

This small input of electricity is a defining factor in the Burns family's lifestyle. The appliances and electronics that characterize most American households are virtually non-existent in this house. There is a Sun Frost refrigerator and freezer.

Andrea was clear about it, "I have all the modern conveniences—TV, computer, internet, kitchen appliances, and a sewing machine. I wouldn't want to live any other way. The big difference is that we turn stuff off."

After more than twenty years of happily living this way the Burns reaffirm daily that this how they want to live.

Wes Golomb is a long-time clean energy and climate advocate from Deerfield, NH. ☕

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Serious Weatherization – Cont'd from p. 30

developers. These regional agencies will sometimes have a 'branch' of their operations providing work in these situations.

WHAT HAPPENS AT YOUR HOME

Weatherization activities in our region aim to improve the thermal efficiency of buildings, but in the process make cooling easier to achieve. The services and tasks performed, often called "measures," vary, but it is safe to say that all are based on evolving, sound building science, analyses for cost effectiveness over time, and incorporate years of practical experience.

Once an application is accepted, an energy evaluation is done to determine what measures will be required. This includes a structural inspection for needed carpentry and construction repairs. Lots, maybe most, buildings leak air due to faulty, sloppy construction (whether new or old!), deterioration such as missing basement windows or large gaps in foundations or walls, modifications for utilities and services, and any number of other reasons. A lot of that can be addressed with carpentry, even crude fixes if it is out of sight, but it must be done before other weatherization measures can be effective. Some programs offer assistance with such repairs.

We should note that some weatherization activities and work is done by agencies that are not regional WAPs. A notable example of an organization dedicated to overall or general home improvements is COVER Home Repair of the Upper Valley of NH and VT (<https://coverhomerepair.org/>). The agency uses staff and volunteers to help with roofs, access ramps, grab-bars, stairways and weatherization work up to a certain level. They are based in White River Jct., VT and serve people within a 45-minute radius and with incomes up to 60% of the area median income (\$3415/month for two person households).

Next, typical activities, in a rough sequence, will include blower-door testing; air-sealing (which is all-important), and improvements to the whole heated



or conditioned volume of the house (the "thermal shell") with appropriate insulation types. Under some regional WAP agencies, some buildings can receive new mechanical systems particularly heating systems.

The measures done to a building, following WAP's methods, have varied and generally improved over the many years WAP has been in operation. To some extent these measures vary by region, because the regions have different climates and conditions.

In the Northeast, some examples of measures that have changed would include the following.

Materials, especially insulation.

Over time, insulation materials have changed, mostly for the better. Once, fiberglass was king, but that is long past; it is uncommon to use it now. Instead, spray-applied foam is used, along with blown in (or on) cellulose. Foam-board insulation products are often used. Spray foam is common to use in basement interiors and crawl spaces (including on the 'floors' of the latter). Spray foam can also be used to seal an attic floor, to make it almost completely resistant to air (and moisture) leakage from the heated area below. Rock wool or Roxul™ (batts, or semi-rigid boards) is often used where suitable. Insulations perform differently, and are suited to varying degrees to different locations and installations. There is no one ideal insulation for all situations.

Unfortunately, in light of its benefits, some foam insulations can be a cure worse than the disease due to the use of certain gases in manufacture or application that carry potent global warming po-

tential – in some cases 1,000 times more potent than carbon dioxide! Without careful attention to this issue, applying foam can lead to a global warming impact that negates any value from the entire fuel savings over the lifetime of the house. Please see the article following.

Foundation treatments.

In the past, fibrous insulations were used a lot, including between floor joists. This is rarely done now; fibrous materials in general don't go in foundations and basements. A quarter century ago, moisture resistant sacks were used to enclose loose insulation on basement walls, but you rarely see this done now. Currently spray foam is the option of choice, and it has to be treated to be ignition-resistant (typically by a paint, sheet goods, or an admixture). If a building is new or excavated, foam boards can be used effectively.

Attic treatments.

As mentioned above, sometimes attic floors are sealed with spray foam. This seals most or all of the many gaps that are common at this level of a building. Once sealed vast amounts of cellulose are blown on top. With air and vapor leakage greatly reduced, the necessity of extensive attic venting is lessened; resulting in far less use of gable end louver vents, ridge vents, and other fixtures.

Buildings increasingly have many different and innovative configurations and assemblies, and so what is used, and where and how applied, can vary per the desires of the designer or the evaluation of a weatherization staff. These professionals will work closely with you to make the right choices for your particular home or building that will lead to a fatter wallet and a significantly reduced impact on the planet.

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. ♻️

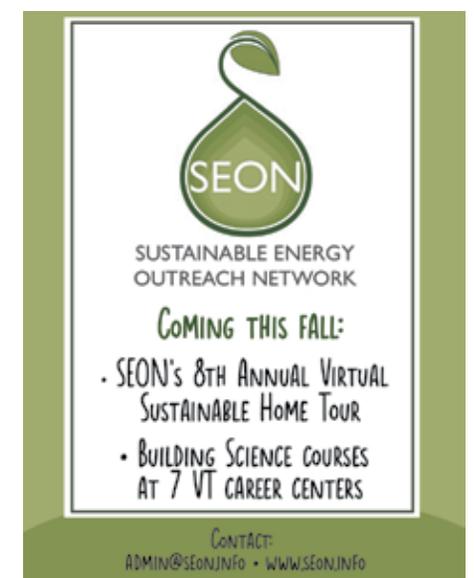
WEATHERIZATION TRAINING

Guy Payne

Most weatherization technicians in the Weatherization Assistance Programs (WAP) have received training from both the state and locally at the various regional WAP agencies. Private weatherization companies typically use on-the-job training and formal training at the company headquarters. The energy auditors for both public and private organizations are certified through Building Performance Institute (BPI).

A key learning component of all training must include a basic understanding of building science, the physics of how water, air, and heat travel through a building. It is especially important in the northeast to manage energy efficiency, water, and water vapor with equal intensity. Training in basic building science will be available at many of the local career centers and taught by experienced high performance building professionals. Efficiency Vermont will have information on local building science training organizations and training locations.

Guy Payne is the executive director of Sustainable Energy Outreach Network (SEON) in Westminster, VT. Visit www.seon.info. ♻️

**Cautionary Words About Foam Use and the Impact on Global Warming**

Junio Anthes-Mood



People do have reason to be concerned about using foam where other alternatives are just as viable. All foams that we use are made of plastic, but they vary in the blowing agents that make the

tiny bubbles that turn plastic into foam. Some foams such as foil faced polyisocyanurate (commonly called "polyiso" and has several different brand names) and expanded polystyrene (EPS) have blowing agents that are relatively benign, and have low global warming potential. Foams such as Spray polyurethane foam (which is applied in homes using specialized spraying equipment) and extruded polystyrene (XPS, commonly called blue-board or pink board) have blowing agents with global warming potentials that are much higher. Vermont passed legislation that eliminates the worst of these blowing agents, but the allowed ones still have much greater global warming potential

than those in polyiso and EPS.

We can't just eliminate foams from all of the work that we do because they have properties that aren't easily replaced by other materials. We understand that there are issues that we need to address and improve upon, and we will continue to recommend spray foam in basements, EPS around foundations, and polyiso in a number of places. The key is to understand what properties are needed and if there are more environmentally friendly alternatives that are available that can be used by the people performing the work, and are affordable for the homeowner.

To further understand the long-term environmental impacts of any building materials researchers and contractors look at Environmental Product Declarations (EPDs) that are developed by manufacturers and industry associations. These EPDs each have a lifecycle analysis that show expected environmental impacts of those materials. These EPDs cover more effects than just global warming potential. This isn't an easy task, but learning how to compare products this way is important

for industry professionals who are interested in this work.

There is progress being made on determining the actual impact of these foams for global warming, but we have to remember that reducing fossil fuel consumption is the primary way that we have to have a major impact on global warming, and weatherization is the primary method for reducing fossil fuel consumption in existing homes. As we eliminate fossil fuels from our electrical grid, using heat pumps will become the next most important method.

More information regarding foam insulation can be found at https://bit.ly/Finehomebuilding_SprayFoam and <https://bit.ly/GreenInsulationProducts>

Junio Anthes-Moody is an energy efficiency professional based in southern Vermont. He has been performing energy audits for over a decade and has worked in Vermont, Massachusetts and New Hampshire. He taught weatherization, mentored energy auditors, and performed thousands of quality assurance inspections in that time. Junio is working with SEON to expand its teaching programs in the year to come. See more at <http://www.seon.info>. ♻️

Gas or Plug-In Car?

Cont'd from p. 6

percent of public charging stations are free.

Hybrids: Hybrids can achieve MPGs in the 50s, and even a few subcompact ICE vehicles can reach 40 MPG.

Conclusion

Economically speaking EVs, new or used, are hands-down winners compared to their ICE counterparts. PHEVs are somewhat closer to ICE vehicles in operating costs overall, while offering the extended range of a gas engine that will suit the needs of longer commutes and road trips.

Wayne Michaud is Executive Director of Green Driving America Inc., a non-profit that advocates for and educates on transportation efficiency and cleaner transportation. The organization is based in CA with a branch location in VT. Michaud headed Idle-Free VT in VT from 2006-2016.

¹ Available in AWD for about \$2,500 additional; AWD base model range 217 miles

² MPGe is "miles per gallon of gasoline-equivalent"; it measures fuel efficiency of vehicles that run on non-liquid fuels, such as PHEVs and EVs

³ Optional Mach-E models more competitive in acceleration

⁴ The mileage disparity between Civic's 100,000 vs LEAF's 75,000 is that, typically, used EVs travel less due to their limited range. ♻️



Larry Plesent

Ingredient of the Month Aluminum Cans: Friend or Foe?

A concerned reader wrote in with questions about food and beverage cans. Are aluminum cans an Alzheimer's risk factor? And are there natural protective measures we can take to lower our risk factors for this and other neuro-degenerative diseases?

Do metal cans increase the risk of Alzheimer's? Probably not. Nearly all food and beverage cans are coated, inside and out, preventing contact between metal and food. A small percentage of uncoated cans are still in use for lightly acidic fruits such as canned peaches or pineapple chunks in syrup. It seems the tin coating absorbs oxygen quickly and discolors before the syrup and fruit so your dessert looks fresher. Pretty much everything else has a plastic coating. Even the aluminum and magnesium lids of pop top cans are often coated from the varnish used to keep ink from running on the surface of the printed can.

Alzheimer's is a disease where one's own body secretes a mixture of proteins and metals (for our purposes here, let's call it brain goo) outside and on top of the brain. This brain goo or plaque then proceeds to destroy brain tissue, reducing

us to a much simpler version of ourselves. Scientists analyzing the brains of Alzheimer's patients have found a definitive link between certain common metals and the toxic, brain destroying goo.

Technology marches on and thanks to improvements brought to us by the 2015 smart phone technology revolution, we can now measure these metals with greater accuracy than ever before. The results are somewhat unexpected and may one day offer more treatment options.

Although two earlier studies showed traces of aluminum in two Alzheimer's brains, newer, larger studies done with today's more sensitive instruments have yielded different results. While aluminum exposure may be implicated in a small number of cases, the primary metals found in the goo were iron, copper, and to a lesser extent zinc. When these commonly used metals were further analyzed, it was found most of the metal content in the goo came from magnetic iron. Magnetic brain goo is directly linked to the destruction of brain tissue and disruption of the electro-chemical processes the brain uses to function normally.

The metal and Alzheimer's link looks like

IS ALZHEIMER'S LINKED TO ALUMINUM?

this: In nature, metals are almost always found bound tightly to other elements and as such are quite stable. It takes heat and electricity to

refine these impurities out and produce a pure usable product. Unfortunately, our modern lifestyle offers multiple exposure paths for the absorption of these reactive metals. (Additionally, we now know that certain genes greatly increase the risk of developing the disease.)

Magnetite (magnetic iron) is naturally found inside all human and animal brains and is concentrated in the brain stems of mammals. Magnetite crystals in the brain are suspected of being directly linked to migratory behavior and probably to the ability to sense direction. However, if small amounts of magnetite in the brain is natural or even desirable, magnetite on the brain is definitely not.

The human body appears to have difficulty getting rid of certain excess metals that it acquires simply from breathing, eating and drinking, some of my very favorite pastimes. The metals circulate for a while, sometimes for years, while the body tries to figure out what to do with them. Eventually they can end up being excreted out of the body by neurons as the now famous "brain goo" or plaque.

Is there a medicine or food one can take to protect the brain from degenerative diseases such as Alzheimer's, Lou Gehrig's and Multiple Sclerosis? Surprisingly, there is a purported natural, patented substance that claims to do just that.

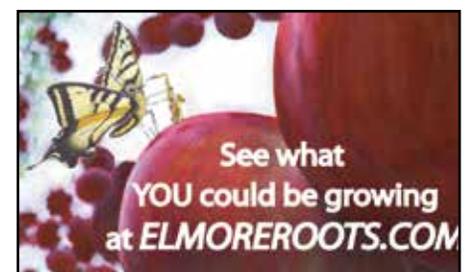
THC containing cannabis is now known to have a strong protective effect on mam-

mal brains. In fact, the U.S. government patented the neuroprotective effects of cannabis way back in 2003, and then sat on the patent while tens of millions of citizens suffered and died from neurodegenerative diseases. Cannabis products are also anti-inflammatory and cross the blood-brain barrier to influence the brain directly. As an example of this, when my 89-year-old father got long COVID along with inflammation in his brain, I gave him large doses of full spectrum CBD (300 mcgs daily as multiple doses). The results were immediately noticeable to all observers. He continues to take smaller amounts for cognition and to help him sleep. The doctors continue to insist there are no anti-inflammatory drugs available for inflamed brains available at this time.

THC has been definitively shown to prevent the formation of new Alzheimer's brain goo, and exhibits a protective effect on the brain, helping to prevent those with a genetic propensity for the disease from coming down with it. This is not just theoretical speculation, as shown by the granting of a patent for cannabis's neuroprotection properties. Diseases like epilepsy and Tourette's syndrome are also positively affected by cannabis as THC calms the brain's so called "excitatory mechanism."

The old stories about

Cont'd on p.39



ELMORE ROOTS' PERMACULTURE KNOW-HOW

The Beat Goes On...

My friend I grew up with organic vegetables as far as the eye can see. He puts stickers on his boxes of cabbage that state, "Let's get our heads together." On his boxes of beets another sticker reads, "Beet the system!"

We grew up in a time where we did not like what we saw going on around us. People were marching and demonstrating and making peace signs with their fingers and wearing flowers in their hair. We headed north where it was greener and simpler, and the open road led to open land and so many possibilities. We both became farmers. Growers of food. Purveyors of hope.

One of my teachers said that his uncle Joe taught him the only time it was ok to look down at someone was when you were reaching down to help him up. We each have so many chances each day to lift someone up. I recently have been experimenting with less complaining and more helping people around me. This helps the world directly, and it also feels like I am doing what I am meant to do. Small things like singing a song to someone. Telling someone they are looking great. Reminding the person working in the store that they are making a lot of people's lives better, because they help them find what they need that day. We are all modern troubadours travelling about in our time and in our neighborhoods spreading our song of the day. All of the energy we could spend sharing what annoys us about a politician could be transformed into listening to a friend and giving them encouragement. Or sending a poem by letter or email to a friend we know could use it.

What is the system, anyway? I am part of it, and I will beat it by the way I say hello to the mailman. When I see the rain



Watercolor painting by Joyce Dutka

coming in, instead of only seeing my picnic is cancelled I see it nourishing the trees and the roots of flowers. My parking ticket fee is helping the sidewalks to get plowed in the winter and the crosswalks to be painted. When someone comes for a plant from us and I see they are having some challenges, I can gift them that plant or give them a much larger one than they would get for that price.

Imagine if the first things we were taught in kindergarten were to be kind to each other. If something does not feel good to you, don't do it to somebody else. We beat the system by living a life that is inspired by what we can bring to it each day. Following through on the ideas coming down just to us. Hugging the moment that is here right now. Not being afraid to be different. Or being a bit afraid and being myself anyway. We are all artists of our own life. Whether you feel your best in a garden or in the theater. Give it your best. Whether you play an instrument or not, the beat goes on.

David Fried is the propagator and grower at Elmore Roots Nursery and is very proud of his perennial vegetable rows. ♻️

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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

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.encyvermont.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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Building a Permaculture Garden in Italy

The Geobarns Team

As the son of an immigrant father, it has always been our founder George's dream to return to Italy to honor his father's achievements in America by replanting the family roots in his native soil. We were fortunate to find good land a few years ago in Rochetta, a place reminiscent of his father's hometown of Arcetri, near Florence. George's son Caleb lead the Geobarns Europe team developing the and began planning construction in earnest.

However, buying the land was the easy part. Gaining approval from the Italian authorities while navigating unfamiliar laws and customs was no easy task. Seven years later, we have only just begun building, yet among the delays and challenges, we have not been idle. The land came with remnants of a garden and a vineyard that had grown wild through neglect, so we set about rehabilitating the land while our applications worked their way through the labyrinthine local bureaucracy.

The delays gave us a most precious treasure: time to observe and study the natural conditions of the land, such as water flow, sun, wind, and wildlife. We wanted to do more than just prune and weed. To be good stewards of the land, we needed to rebuild an integrated ecosystem that could sustain itself naturally, without relying on chemicals, external supplements, or producing waste. Each component of our garden — soil fertility, water conservation, microbe and pollinator habitats, plant diversity — needed to connect and support the others. The solution lies in Permaculture, an approach to land design that uses a set of ethics, "thinking tools" and techniques to build the integrated ecosystem we desired. The term is a contraction of "permanent" and "agriculture," and it implies long-term resilience.

A first step was to improve soil conditions in the garden area. We adopted an ancient technique called Hugelkultur, a German word that translates roughly to 'mound culture', in which our crop plantings are grown in raised beds that resemble mounds. A good Hugelkultur bed is built in layers, much like a lasagna. The base layer is built with decomposing logs, tree limbs, and twigs — the more decomposed the better. The next layer is made from loose organic material, such as grass clippings, fallen deciduous leaves, and plant waste. These should be tightly packed into the first layer. Continue building alternating layers of rotten tree branches and plant waste until the mound is at least a couple feet high. If livestock manure is



This long-neglected olive orchard will soon bloom again. Pruning is kept to a minimum to avoid stressing the trees and opening vectors for disease and insect infestation. Rt: This water collection pool does double duty as storage with natural filtration and a source of water for birds and small animals. (Courtesy photos: Geobarns).

available, this can be packed in as well. Once you've built your mound, water it thoroughly over several days, until mushrooms begin to sprout.

The result is a crop bed absolutely packed with nutrients. It's also a healthy environment for microbes and small invertebrates, such as worms, which open tunnels in the crop bed to admit critical nitrogen from the atmosphere. Further, the decomposing wood retains rainwater and provides an enduring heat source for microbes and plant roots. Hugelkultur is an example of an intentional permaculture goal of stacking multiple functions and benefits into one system, like any healthy ecosystem that evolved naturally.

The garden is similarly built in a diverse, multi-layer mix of fruit and nut bearing trees, shrubs, and ground cover; much like plant communities found in nature. Apple and pear trees add to our crop production while providing canopy habitat for insects and birds. The shrub layer includes nitrogen fixers and bioaccumulators, which draw nutrients up from deep in the soil and make them available for plants on the surface. Once a year, plant waste from pruning and harvesting is collected and chopped up into a nutrient rich mulch. Strawberries, herbs, and other plants form the ground-cover layer.

Water management was another task. We discovered the remains of an old water collection basin, which we restored and enhanced with stone facings into a bio pool to reduce erosion, establish water security, and provide an aesthetic and recreational amenity. It's now the centerpiece of the garden and, with a little encouragement, has bloomed into a micro-environment all its own. The bio pool also gives us peace of mind as a potential source of irrigation water in the future.

The garden begged the help of bees to

sustain it, so we hired a local beekeeper not only to bless our land with new colonies but to replenish the regional wild bee population as well. A recent visit from a Ph.D program researcher attested that after a few years of sustained effort, she has never seen a property as filled with insects and thriving biodiversity as ours. Success!

shrubs. The Etruscans discovered that grape vines can be trained to grow up tree trunks, improving yields and making harvesting easier. The technique is commonly known by the French term espalier, but in Italy it is called vite maritata, or 'married vine'. Fully matured grape espaliers can span wide distances between trees, and the technique has evolved into the modern vineyard we see today: long rows of intertwined grape shrubs supported by trellis fencing.

Waiting for the building permits gave us something more important than we expected: a deeper connection to the land and community. As we applied permaculture design principles and techniques to the gardens and reveled in the bees and insects establishing their healthy homes with us as well within the broader ecosystem, an abiding sense of belonging filled our hearts. In the beginning, our mindset was to restore an old garden as we marked time waiting for approvals. Yet along the way, we forged new friendships, shared our knowledge, and learned from others, and together built a demonstration project that has won enthusiastic support from the local community, generated new work, and boosted the spirit of many.

And this is the serendipitous fruit of our labor: George's father grew up in Italy and moved to America, but in a sense he never left. He has always belonged to Italy as much as he belongs to America. Building this permaculture project together helped us realize that the same is true for us all. We belong to the land, wherever it may be. Let us nourish it as much as it nourishes us.

The Geobarns team authors include George Abetti, founder, Casey Williams, site stewardship managing partner, and Caleb Abetti, project manager. ♻️



Finally, we turned our attention to the vineyard. Here we adopted another ancient technique pioneered by the Etruscan culture near the end of the Bronze Age. Wild grapes are a species of liana, which are climbing



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Aerial view of the garden and vineyard during restoration. Note the remains of the centuries-old farmhouse (bottom center) and the new Geobarn foundation at left.

Beating Blue-Green Algae

Jessie Haas

Nothing ruins a summer day like getting to the beach and discovering it's closed due to a blue-green algae bloom. Or having your dog get sick from it. Or getting sick yourself.

Blue-green algae, a form of cyanobacteria, is natural and ancient. It blooms under conditions of excess nutrients in still, warm bodies of water, and then dies as rapidly as it came. However, the death process consumes large amounts of oxygen, harming or killing aquatic life. Some species also release toxins which may linger after the bloom is apparently over. These are harmful, sometimes lethal, for humans and animals, with dogs and children being most vulnerable. Many dogs die every summer from swimming in contaminated water. Some species of blue-green algae are also associated with major, long-term illnesses like Lou Gehrig's disease. Not all types of blue-green algae are toxic, but it's difficult to know what you're looking at if you're not an expert.

There is an ongoing interstate and international effort to reduce algae blooms in Lakes Champlain and Memphremagog, which focuses heavily on farming and the built environment. But homes in the Champlain Basin, with their surrounding lawns, also make an impact on bodies of water. We can all play a role in reducing the excess nutrients being washed into our ponds, lakes, rivers, and ultimately Long Island Sound, by modifying what we do in our watershed.

Many solutions focus on lawns, and it's time to face facts. That close-clipped patch of greensward is a biological desert, which displaces native species that once thrived there. Not only that; the care we lavish on that grass, including mowing, fertilizing, and pesticides, makes the lawn an active threat to the natural world around it, particularly

bodies of water. (Golf courses, we're also looking at you!) Lawn turf has short roots, which do not absorb and sink water very well. That makes your lawn more like an impervious surface than like a natural meadow; everything you put on it will wash right off again during a heavy rain, straight into the nearest stream, lake, or pond.

There's a lot we can do to change that, and refreshingly, it involves doing less work, not more. Make that lawn a lot smaller. Rewild the margins, especially near ponds and streams. Riparian buffers aren't just for farms! Allow native perennials and shrubs to grow near the water's edge, or choose and plant them according to your taste. These deep-rooted plants will divert and sink run-off from your property into the ground, while feeding bugs, birds, and maybe you, depending what you choose to grow. If you think the neighbors will complain (people do tend to be "judgey!") put up a little sign saying "This is an ark," or "Lake Protection Zone," or whatever tickles your fancy. Golf courses, which will have difficulty with some suggested practices, might be able to install wild buffers.

Fertilize less, or not at all. Grass usually does just fine without it. If yours doesn't, that's a sign that it's truly out of its comfort zone. Take the opportunity to reseed with



A blue-green algae at Clear Lake, California, resulted in oxygen depletion in the water and the subsequent mortality of multiple aquatic species, including carp, catfish, bluegill and crappie. (Kirsten Macintyre/Flickr)

something that needs less care. Dutch white clover is pretty, feeds pollinators, gathers free nitrogen out of the air, and never gets tall.

Mow less often. No Mow May is a movement asking homeowners to skip mowing their lawns through the month of May, to allow pollinators to feed. When you stop mowing, you will find new plants emerging from the seedbank, deeper-rooted perennials like ajuga, violets, dandelions (gasp!) and others you may have previously considered to be weeds. Enjoy them, watch who feeds on them, and consider making them a permanent part of your landscape. A pusher look on the surface is a sign of deeper roots underground, which sink and absorb water and nutrients. You can also let the grass grow tall, and mow walking paths through it.

Plant trees – native trees. They absorb significant amounts of water from rain and snow melt, and provide cooling through their shade and transpiration. That's a benefit to both you and any nearby body of water, as algae blooms are triggered by excess heat.

Rain barrels catch and divert the flow of water from your roof. Use the captured water in your garden. Or guide it, and the runoff from your driveway, into a rain garden, an attractive patch of native plants designed to catch and sink excess water

from heavy rains. Rain gardens also attract frogs, salamanders, pollinating insects, and birds.

If you have a pond on your property, you can prevent algae blooms by installing an aerator or fountain. But along with that, look at first causes. How is that extra fertility getting into the water? Identify the sources, and buffer them. If you have vegetation near the bank of the pond, mow and rake in the fall, so the excess nutrients don't end up in the water next spring. Put the clippings on your compost pile, or chip them to mulch other plants. Similarly, clean up pet droppings and dispose of them, and don't let livestock graze the banks of a body of water, except in the fall as an alternative to mowing.

Speaking of excess nutrients, if you live near a body of water, it's important to make sure your septic system is in good working order. You don't want your leach field leaching into a stream or lake.

Everything you do to help keep the water free from algae blooms will beautify your property, increase the life there, and help cool your particular part of our fevered planet. There's literally no downside.

Links provided in the online posting of this article at greenenergytimes.org.

Jessie Haas lives in a 450 square foot off-grid cabin with husband Michael J. Daley. She is the author of over 40 books, including *The Hungry Place*. ☺




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"Most electric boats on the market today are range-limited. With better panels, batteries and motors, we've produced a solar boat that can continuously cruise without ever charging from the shore." - Capt. Alex Borton

After college, David Borton and his bride of two weeks taught math and physics in Ghana for the Peace Corps. Two years later they went to graduate school in physics where David got a Ph D, Harriet got a masters, and they started a family with two children.

When David Borton retired in 2014, after 33 years of teaching solar energy engineering at Rensselaer Polytechnic Institute, he chose "Live Your Values" as the guiding principle for his startup company: Sustainable Energy Systems.

Clearly David values innovation and practical, sustainable solutions, because after only eight years they have become the leader in solar boating, with a U.S. patent for high efficiency solar powered boats, yachts and other aquatic vessels, they've produced three different types of crafts from 24 to 44-feet in length, and have produced a remarkable series of breakthroughs: the only Coast Guard certified 100% solar-powered commercial passenger boat, the first 100% solar voyage through the entire 1,200 nautical mile Inside Passage from Washington to Alaska, the first cargo delivery on the Erie Canal powered exclusively by the sun, and



The SS-24 is the first fiberglass hulled all-electric, solar powered boat, and is approved for manufacturing by meeting all the U.S. Coast Guard regulations. It measures 24' long, holds 10 adults, and features four 360-watt solar panels and four 3500-watt lithium batteries that power a 3,000-watt Torqeedo electric outboard, comparable to a 6-hp gasoline motor, to a top speed of 6 knots (Courtesy photos)

now the first fiberglass solar recreation boat available in the U.S. and Canada. The Solar Sal 24, designed by acclaimed maritime architect J.F. Bedard, features a high-quality hand-laid fiberglass hull, with a canopy roof that contains 1440 total watts of PV panels; enough to drive a high efficiency Torqeedo outboard electric motor. This powerful configuration, assembled at Belmont Boatworks in Belfast, Maine, provides unlimited quiet, clean cruising on lakes, rivers, sounds or bays during daylight hours without tapping into the 14,000 watt-hour-capacity lithium batteries. And there's no range anxiety on the water, because she can travel for four hours at full speed without the sun; as far as 100 miles on battery power alone.

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



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Aluminum Cans

Cont'd from p. 35

marijuana destroying brain cells have been shown to be nothing more than propaganda, completely without scientific basis. Like any drug, use THC cannabis with caution, be aware of possible side effects, and use extra care when operating machinery.

And when you do use aluminum or tin cans, be sure to wash and recycle them. Among economically developed nations,

U.S. has one of the lowest rates of can recycling. Seems a waste of resources to some of us thrifty country people.

In future articles, we will take a deeper dive into the world of metal coatings in food and beverage cans, and their links to cancer which, in this writer's opinion, constitute a much greater risk to our health and wellbeing than the cans themselves.

Larry Plesent is a writer living in the Green Mountains of Vermont. Learn more at www.vtsoap.com and www.reactivebody.com. ♻️

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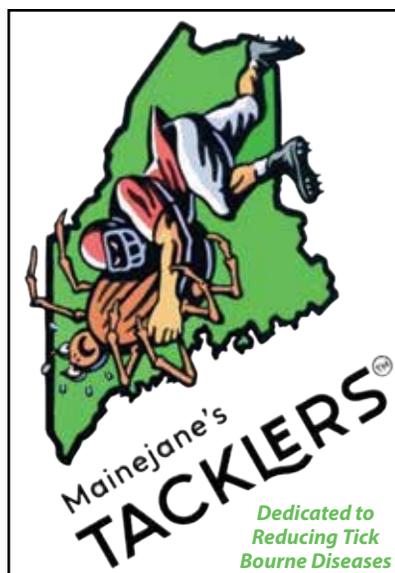
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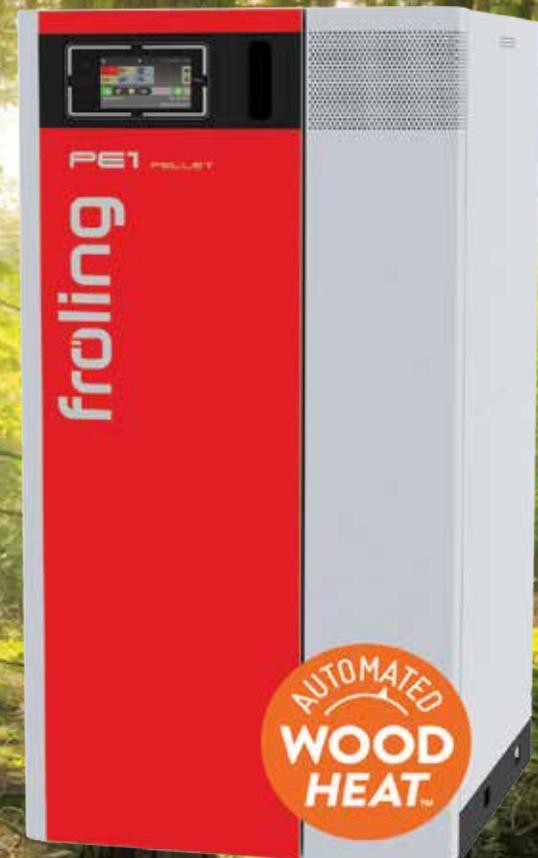
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