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Delay Is Death

Bob Berwyn

The February 28th report on climate impacts, vulnerabilities and adaptation from the Intergovernmental Panel on Climate Change was finalized just as Russia invaded Ukraine. Russian scientists at the online approval session Sunday apologized for their country's invasion, while the war drew Ukrainian scientists away from the meeting.

Russian tank. Kevin Schmid, Unsplash/3WSwo5b

It might be hard to concentrate on the new science assessment as a war erupts in Europe, but it's important to focus on both subjects at the same time because they are deeply related, said Rod Schoonover, a climate security expert with the Council on Strategic Risks' Center for Climate and Security, and a former United States intelligence officer.

"You shouldn't shut one or the other off. Humanity's relationship to fossil fuel is underwriting this invasion," he said. "Putin thought he could get away with it because of Europe's dependence on Russian gas."

In the longer term, ending the addiction could even reduce the need for military spending, since much of it goes to securing sources and transportation of oil and gas. "Reducing reliance on fossil fuels enhances national security for the United States and other countries, and we should make that argument," Schoonover said.

In the report, hundreds of scientists representing nearly every country described spiraling climate impacts, with the deadly, destructive effects like floods, famines and wildfires outpacing even some of the most ambitious efforts to adapt. The scientists warned that some of the changes are so extreme and fast that they will push communities beyond their ability to deal with them in places like the Arctic and along some coastlines, and pose a serious threat to food systems in many

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STICK IT TO PUTIN – DRIVE ELECTRIC NOW

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Paul Gipe

You can—and should--do more to help Ukraine than waving a digital flag on social media. You can stick it to Putin, weaken his war machine, and drive a stake through the heart of oil oligarchs, wherever they are, by going electric. Ditch the diesel truck, park your polluter, get yourself an electric vehicle (EV) and drive on 100% American-made electricity.

Every gallon you pump, every mile you drive, contributes to funding murderous Saudi autocrats, who think nothing of dismembering journalists or beheading their citizens, Venezuelan dictators who starve their own people, or a Russian dictator who threatens nuclear Armageddon.

Oil and natural gas accounted for 68% of Russia's total export revenues in 2013 and as much as 40% today. Most of this has been siphoned off to build the tanks now rolling across Ukraine.

If we want to help Ukraine, we have to starve the beast. Biden's banning Russian oil isn't nearly enough. We must wean ourselves off oil entirely because it's costly, fuels despots, and leads to war--not to mention drought, wildfires, and catastrophic climate change.

The farcical clamor from America's oil oligarchs and their paid political pawns, who want to drill anything that doesn't move, conveniently ignores a fundamental fact. Oil is an international commodity. It's not "our" oil. It's the property of our own price-gouging plutocrats who are sitting on the leases to drill what they already have, raise prices at will, produce

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DIY Raised Bed Gardening

Lydia West

So, you've done some research and decided that raised garden beds are for you. Now you need to decide what lumber to use, and get some tips on just how to construct your beds.

Beautiful raised bed garden made of eastern hemlock sawed by Goosebay Sawmill and Lumber. (Photo: Anthony DelGreco)

Wood Characteristics You Should Look for

The wood that you use is going to be constantly wet and will have soil against it. You need something that will stand up to this abuse and that, at the same time, is safe for your produce. Pressure treated wood may seem like a great choice. It's readily available and is meant to survive for years in the ground or in applications where it is constantly wet.

However, you need to be aware that heavy metal chemicals are used to treat the wood to make it rot-, decay-, and bug-resistant. This is true even for the "new, safe" pressure treated wood that has been for sale since 2003. These toxins

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Concentration of CO2 in the Atmosphere

418.81
parts per million (ppm)
April 7, 2022

Learn more at www.CO2.earth.

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GREEN ENERGY TIMES (G.E.T.)

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Green Energy Times is produced by 100% solar power, off-grid with a 3.8 kW PV system. We live and know that Energy Independence is indeed possible – with clean, sustainable renewable energy along with reducing your needs. We walk the talk!

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

Solar Power works! … anywhere under the sun!

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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 Our Awesome Team

Helping *Green Energy Times* Save the Planet

Part Four in Our Feature Series

All of us at *Green Energy Times* are proud of the fact that our volunteers and workers do their part. Our feeling is that if everyone were as conscience as they are, planetary issues would be easy to solve. Here are two more examples of their own stories.

Janis Petzel – Contributing writer, Isles-boro, Maine.

Dave Petzel, Janis's husband, modified a standard house plan from a lumberyard, made sure it was sited properly for passive solar gain in the winter and reduced gain in the summer. When we built it, we chickened out on being off-grid (too bad, I think now we could have done it. We put heating oil monitors in back-up our woodstove. Over time, as things need replacing, we've been getting rid of the fossil fuel input to our home. We have solar panels, an electric vehicle, and a water jacket on the woodstove which provides heat to the bathrooms. It's an efficient, comfortable house.

The water heated in the woodstove water jacket goes to an insulated water tank and is then circulated to our bathrooms and to radiators in the basement, keeping the floor on the first floor warm. The back-up heating oil-fueled Monitor in the guest bedroom is only turned on when we have company. Otherwise, there is no direct heat upstairs. Between good insulation, insulated shades on the windows which we pull down at night, the woodstove, and the water jacket, the house stays comfortable.

Plumbing for the water jacket at the back of the woodstove. The white wire is a temp. probe. (Photos: Dave Petzel)

Inside view of our Nectre wood stove. The black rectangle is the water jacket.

The roof of Jim Van Valkenburgh's home has both solar PV panels to produce electricity and solar thermal panels for heating water. (Courtesy photo)

Jim Van Valkenburgh – *G.E.T.* volunteer distributor, Peterborough, New Hampshire

My wife and I have been living in a 1980s vintage saltbox with a 21' long sunroom to the south and pretty good insulation. The sunny sunroom adds a lot of heat on sunny, winter days and provides a buffer to the cold winds of winter. Fifteen years ago, we had solar hot water installed to keep our electric water heater from running most of the time. One year ago, we filled the rest of the roof with 26 solar photovoltaic (PV) panels for 6kW of capacity. South Pack Solar did the installation. That has brought our electric bill down to $Zero. We started out heating with a wood stove and about 100 gallons of oil in our "back-up" furnace each winter. Eight years ago, we installed a pellet stove that burns 3-4 tons per winter. The easy automation of the pellet stove cut our oil use to an average of just 60 gallons per year over that time.

Wood and pellets have been the least-cost heating fuel over the past 22 years of living in this house. When oil fell to less than $2 a gallon last year, it was tempting to just turn up the thermostat, but we continued to burn wood pellets instead, keeping our heating fuel coming from local sources. We try to live by the principles of being local and sustainable, so long as we are able to lift and carry the bags of pellets each winter ♻

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NYS Is the Top Community Solar Market in the USA

On March 22, 2022, Governor Kathy Hochul announced New York State has become the top community solar market in the United States with more than one gigawatt (GW) of community solar installed and operational - enough to serve 209,000 homes across the state. NYS also has the largest solar pipeline in the nation with enough community solar under construction to serve an additional 401,000 homes, ensuring continued access to clean affordable solar for all NY-ers for years to come. This announcement accelerates progress towards meeting the Climate Leadership and Community Protection Act (Climate Act) goal to generate 70% of the state's electricity from renewable sources by 2030 and the governor's goal to achieve 10 GW of solar by 2030.

Community solar supports NYS' goals to generate 70% of the state's electricity from renewable sources by 2030 and for 10 GW of solar by 2030.

"Reaching this nation-leading milestone - with more than 1 GW of community solar installed is a testament to NY's aggressive pursuit of clean-energy alternatives that will supercharge our economy and bring us one step closer to a carbon-neutral future," Governor Hochul said. "NYS is once again making clean energy history, and with many families facing the burden of rising energy costs, my administration remains committed to expanding access to solar energy, which will deliver savings and stabilize electricity bills while meeting our aggressive climate goals."

"Over 1 GW of progress was made today, enough to power over 200,000 homes across New York State," said Lieutenant Governor Brian Benjamin. "When we think about the future of our state, we must think about both the economic prosperity we aim for, in addition to the welfare of our children. Now, when those future generations of NY-ers look toward today, they'll know progress was made with them in mind. I'm proud to announce today that NY is the capital of solar power in the United States."

Lieutenant Governor Brian Benjamin made this announcement in Schenectady County at a 7.5 MW community solar project that is paired with 10 MW hours of energy storage on the site of a former landfill. Located in the town of Glenville, the project was developed by DSD Renewables, who is also the owner and operator of the project. The site is part of a seven-project, 25 MW portfolio made possible through a collaboration with the Schenectady County Solar Energy Consortium (https://bit.ly/Schen-Cnty-Solar-Consortium) that provides over $400,000 in energy savings annually to the municipalities and cities of Schenectady County and enables each of the municipalities to be powered by 100% renewable energy. Formed by the county in 2019, the consortium includes the County of Schenectady, City of Schenectady, Town of Duanesburg, Town of Glenville, Town of Niskayuna, Town of Princetown, Town of Rotterdam, Village of Delanson, and Village of Scotia.

The Helderberg solar farm is a 200kW system, with power supplied by 600 solar panels. It was built in Johnsonville, NY, and went on line January 2017. (Photo: Monolith Solar)

Community solar enables access to solar for homeowners, renters, and business owners who may not have ideal conditions to directly install solar panels onsite. Through this arrangement, clean energy is still delivered by a customer's regular electric providers, and the power produced from the solar array is fed directly back into the electric grid. As the electric grid is supplied

Cont'd on p.11

Earth Day/Green Up Day 2022

Earth Day April 22nd

While every day is Earth Day at *Green Energy Times*, the official Earth Day is celebrated annually on April 22nd.

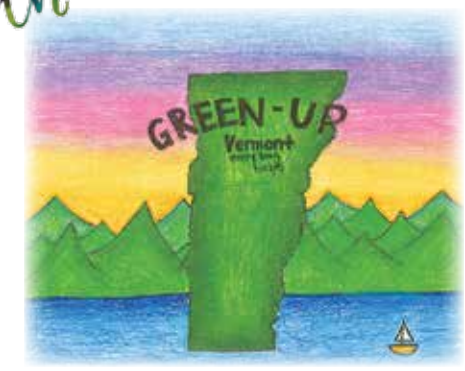
First held in 1970, this day was designed to foster appreciation for the earth's environment.

Check out events in your local community on how you can help celebrate Earth. Learn more at www.earthday.org. ♻

Vermont Green Up Day May 7th

Always the first Saturday in May, Green Up Vermont rallies thousands of volunteers across Vermont to get outside and clean up roadsides and waterways. This year Green Up Day is on May 7th. This is a statewide spring-cleaning of our beautiful environment. Pick up your free Green Up supplies from your volunteer town coordinator and spend an hour or two picking up litter around your town. It makes a huge difference and it feels great to give back to your community. Learn more at https://bit.ly/VT-GreenUpDay2022.

Congratulations to Marina H, 7th grader from Shelburne Community School for winning the 2022 Green Up Day Poster Contest!



Vermont's 2022 Legislative Update

March 31, 2022

The Vermont Senate passed S.148 the Environmental Justice Bill, by a vote of 28-1.

H.740 the state budget bill passed the House 135-4 with historic levels of one-time funding for climate-related projects including:

- $45m for the low-income weatherization program
- $35m for weatherization for Vermonters with moderate incomes through Efficiency Vermont.
- $20m for "financial and technical assistance for low- and moderate-income Vermonters to upgrade home electrical systems to enable installation of energy-saving technologies," through the Clean Energy Development Fund.
- $5m to create a "Switch & Save" program to allow low- and moderate-income Vermonters to install heat pump water heaters at low or no cost, through the Clean Energy Development Fund.
- $2m for load management and energy storage for low- and moderate-income Vermonters, smaller electric utilities, and municipalities, through DPS.
- $5m for matching funds for Advanced Metering Infrastructure for rural and municipal electric utilities, through DPS.
- $48m to support municipalities with technical assistance, energy assessments and municipal weatherization, fuel switching and other potential energy-saving and resilience measures. This includes $40m in direct grants to municipalities for this work of projects up to $250,000.
- $22m in investments to expand the suite of electric and high-efficiency vehicle incentives.
- $13m in electric vehicle (EV) supply and equipment grants for EV charging stations.

H.715, the Clean Heat Standard with the goal of lowering greenhouse gas emissions from the thermal sector (energy used to heat and cool the places we live and work) passed the House on March 17th after a vote of 96-44. The bill is currently being discussed in the Senate Natural Resources and Energy Committee. Governor Scott has not indicated his support for the bill yet. ♻

STICK IT TO PUTIN – *Cont'd from p.1*

what they want, when they want, and sell to whomever they want.

Here's what you can do now. You can buy or lease an electric car. There are numerous models available and more are on the way. Tesla has two new factories under construction as does Volkswagen. Even laggards like GM and Ford are building factories as fast as they can. The tide is turning toward electric vehicles (EVs), but the invasion of Ukraine has shown us that we must move even faster.

The race to dominate the manufacture of EVs is on, and the U.S. is, as in so many other ways, falling further behind. Last year only 4% of the cars sold in the U.S. were electric. In contrast, EVs were 9% of Chinese sales, and 14% of European sales.

The transition to EVs will happen one way or another. We can either join the revolution and reap the benefits in well-paying manufacturing jobs, or let it sweep over us and buy our cars from China as we do so many other things.

Even in California, the so-called green leader in North America, only 10% of cars sold last year were electric. Compare that with booming EV sales in Europe. In March 2022, EV sales reached 12% in France, 14% in car-loving Germany, 18% in Great Britain, and 26% in Sweden. Even more inspiring is oil-exporting Norway, where EVs were 76% of the market last month and everyone drives on 98% renewable energy. The war in Ukraine will turbocharge Europe's switch to EVs.

In California, you can drive on freedom wind and liberty solar for true energy independence. And more wind turbines and solar panels are being added every day. You can go solar yourself and drive on sunshine. It's now cheaper and easier than it's ever been—and no one owns the sun.

Better yet, you don't have to buy solar panels made in China. You can buy American or Canadian panels at competitive prices today.

In the future, people will be dumbfounded that we burned valuable petroleum to power our vehicles, polluting the air that we breathe as a result, when we could just as easily have used the wind and sun to do it instead.

If you want to help Ukraine fight a Russian despot, dump the pump. Stick it to Putin: walk, ride a bike, or drive electric and refuel at home.

There's never been a more overriding public interest in moving rapidly to domestic, American-made, clean, renewable energy. It's time, as Captain Kirk might say, "Scotty, warp speed ahead for our all-electric, all-renewable future."

Paul Gipe lives in California, has worked with renewable energy for the past four decades and is a member of the prestigious Energy Watch group. He's driven electric for seven years. (pgipe@igc.org) ♻

It's Not Just About Global Warming—Air Pollution and Health

Janis Petzel, M.D.

Startling news from the science journal, Nature: Scientists are running out of children who have not been exposed to toxic air pollution to use as a comparison group for health studies. More than 90% of children around the world are exposed to dirty air from the burning of fossil fuels.

Internal combustion engine vehicles and coal-burning power plants throw nasty stuff into the air—acids such as sulfuric or nitrous dioxide; heavy metals such as mercury, arsenic and lead (unleaded gas did not eliminate this problem); carbon monoxide; carbon dioxide; particulates; formaldehyde; benzene; ozone to name a few.

More than 90% of children around the world are exposed to dirty air from the burning of fossil fuels. (Aliaksandr Marko/Adobe stock photo)

Industrial pollutants and car exhaust infiltrate the small spaces in our lungs when we breathe them in, causing direct harm to our bronchial tubes and our alveoli. This makes asthma and bronchitis worse. But what happens in the lungs does not stay in the lungs.

Microscopic particles known as PM2.5 are small enough to pass through the thin gas exchange membrane of the lung's alveoli into the blood stream. Blood containing these particles is pumped by your heart to your brain and the rest of your body.

Wherever you find gas-or diesel-burning vehicles, you'll find this tiny but toxic particulate matter. In an area where there is even a small amount of air pollution (like your garage in the winter when you warm up your car) you are breathing in these invisible time bombs.

Inflammation from PM2.5 particles is the link between pollution and a myriad of diseases, from non-insulin dependent diabetes to birth defects in babies and to dementias like Alzheimer's Disease. We know that air pollution aggravates Covid, hypertension, ischemic heart disease, cerebrovascular disease (strokes), chronic obstructive pulmonary disease, and is strongly suspected to play a role in some mental illnesses, including anxiety, depression, and suicidal thoughts in children.

The American Lung Association reports that children who grow up in areas high in particulate matter and ozone (components of smog) show reduced lung growth. It's like these children grew up with heavy smokers in the house. And if there were smokers in the house, or sources of indoor pollutants like natural gas burning furnaces or cookstoves, the damage just piles on. Children are at risk even before they are born. Pregnant women exposed to air pollution have a higher risk for pre-term birth and babies with birth defects and low birth weight.

Who do you think is more likely to live near smoggy roads or downwind from a power plant—Bill Gates' family or a poor family? We know there are social determinants of health (also called disparities in health), and they start early. People who have been discriminated against historically get pushed into lower rent housing close to trucking lanes and industrial sites (see the inspiring Duwamish River Community Coalition's work to change this: https://www.drcc.org/).

But living away from freeways and industry is not enough to protect your children. Non-freeway roads, and places where cars idle (including intersections with traffic lights) are areas of high air pollution exposure. On sidewalks, children in strollers get exposed to almost 50% more PM2.5 than the parent pushing the stroller—think of which set of lungs is closer to tailpipe level.

Idling cars and school buses produce tremendous amounts of localized air pollution, measurable in the pick-up lanes at schools. Think of that when you're sitting in front of your child's school with your engine running. What's more, the pollutants are getting inside the car or bus while you're sitting there, so when the kids climb in to go home, guess what they are breathing? Isn't that disturbing?

Equally disturbing: Across the United States, idling in personal vehicles wastes about three billion gallons of fuel a year. Idling in trucks wastes another three billion gallons.

Our fuel purchases fund brutal regimes. For example, the U.S. has been buying the equivalent of 4.9 billion gallons of gasoline and 2.9 billion gallons of diesel in Russian crude oil each year (245,194,000 barrels of crude). While Putin gets richer, our vehicles emit completely avoidable air pollution.

There are so many reasons to stop burning gasoline, diesel, oil and coal. Has one more brutal war by an oil oligarchy (Ukraine is not the first victim, let's hope it's the last) made you decide it's time to stop buying fossil fuels? Good. If not, what's it going to take? How about the immediate benefit to your child's health?

However, it is good to know that children's respiratory health can rebound when the toxic exposure stops before permanent damage occurs. If you're not ready to drive an all-electric vehicle, or your school district has not yet purchased all-electric school buses, at least turn off your engine if you're going to be idling for more than 30 seconds. The U.S. Department of Energy recommends this, and it will not hurt your car.

Janis Petzel, MD is a physician, grandmother and climate activist whose writing focusses 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. ♻

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Gas Cars' Supply-Chain Causes Far More Damage Than EVs - Yale University Study

Barbara Whitchurch

My favorite food, guacamole, has a built-in supply-chain environmental impact. Made from avocados, which are certainly not grown in Vermont, it requires farming, tending, harvesting, packaging, and lots of shipping. And if I want my guacamole pre-smushed and packaged in plastic, that just makes it all worse.

Likewise, a study by the Yale School of Environment (YSE), published in Nature (bit.ly/yale-ice-supply), used lifecycle assessment and energy modeling tools to analyze data about indirect emissions from internal combustion engines (ICE) vehicles compared to electric vehicles (EVs). Researchers calculated what a carbon price on those figures would cost and what effect it could have on the auto market (bit.ly/yale-ice-supply-ct).

Gas cars produce more supply chain emissions than EVs. (Photo: emobilitysimplified.com)

They found that the total indirect emissions from EVs are trivial in comparison to the indirect emissions from fossil fuel-powered vehicles. This is in addition to the direct emissions from burning fossil fuels — either at the tailpipe for ICE vehicles or at the power plant smokestack for electricity generation — showing that EVs have a clear advantage in emissions, over ICE vehicles.

"The surprising element was how much lower the emissions of electric vehicles were," said postdoctoral associate Stephanie Weber. "The supply chain for combustion vehicles is just so dirty that electric vehicles can't surpass them, even when you factor in indirect emissions."

EVs offer a cleaner, lower-emission experience for consumers, but some skeptics still criticize the mining, manufacturing and charging practices necessary for their batteries as too dirty. But, compared to what? Do they propose an available alternative? When compared to ICE vehicles, this study shows how minuscule the cradle-to-grave emissions of EVs are.

(Keep in mind that the supply chain for gasoline itself - oil discovery, pumping, transporting, refining, transporting to a station near you - means that, just as with my guacamole, regardless of what you end up doing with that gallon of gas you bought, it has already caused considerable damage.)

According to lead researcher Paul Wolfram, the study shows that "the elephant in the room is the supply chain of fossil fuel-powered vehicles, not that of electric vehicles." He noted that the faster we switch to EVs, the better — at least in countries with a sufficiently decarbonized electricity supply, like the U.S.

"A major concern about electric vehicles is that the supply chain, including the mining and processing of raw materials and the manufacturing of batteries, is far from clean," said Yale Economics professor Ken Gillingham. "So, if we priced the carbon embodied in these processes, the expectation is electric vehicles would be exorbitantly expensive. It turns out that's not the case; if you level the playing field by also pricing the carbon in the fossil fuel vehicle supply chain, electric vehicle sales would actually increase."

Electric cars have emissions advantages across the entire supply chain, and they're only going to get cleaner. Keep in mind that buying a hybrid simply combines the worst of both worlds, while keeping you stuck with ICE maintenance, repair and replacement costs. (bit.ly/ev-snark).

Barbara and her husband are owners of LEAF and Niro EVs and are Board members of VT Passive House (bit.do/mdx-mec-bldg, bit.do/gkw-li). ♻

The Volkswagen Tiguan Allspace TDi is a gas-powered family SUV. (AdobeStock/365846211/Moose)

The Volkswagen ID.6 is the largest electric SUV in VW's line-up of electric cars. (AdobeStock/436606719/Mike Mareen)

Substantial Incentives to Boost Climate Resiliency in NYS

Accelerating the Electric Vehicle Market

Leslie Vishwanath

National Grid is offering substantial financial incentives to commercial customers in its Upstate New York territory under the New York State EV Make-Ready Public Service Commission order, as part of a statewide joint utility program. The purpose of the EV Make-Ready Program is to accelerate the electric vehicle (EV) market transition through the implementation of public charging initiatives. The goal of the program is to create enough charging infrastructure to support 850,000 EVs in New York State by 2025. This is the most ambitious EV effort outside of California that supports equitable access to clean transportation choices and helps build a reliable charging network.

National Grid is working with school districts across NYS to help them electrify their school buses to meet the state's ambitious clean school bus goals. (National Grid)

By providing greater access and more charging options, National Grid is supporting the growth of EV use. The program will balance the transportation ecosystem, which is the largest contributor of greenhouse gas emissions in the United States, according to the Environmental Protection Agency. Consequently, this program will help mitigate climate change, improve air quality, amplify access to cleaner transportation opportunities in underserved communities, and reduce our national reliance on petroleum.

New York's Climate Leadership and Community Protection Act (CLCPA) addresses the historic effects of climate change on disadvantaged communities and institutes mechanisms to ensure these communities benefit from the clean transportation transition. The CLCPA requires all state agencies prioritize decarbonization in disadvantaged communities to tackle climate change and support healthy neighborhoods. The electrification of vehicles—cars, trucks, and busses–drastically help to reduce air pollution and boost clean mobility options, in these communities.

The EV Make-Ready Program supports New York State's aggressive CLCPA goals by enabling EV adoption. It empowers EV drivers and accelerates the EV market by reducing range anxiety—one of the biggest barriers to EV adoption. In Phase I of National Grid's EV Charging Infrastructure Incentive Program, the goal for Upstate New York was to secure commitments for 300 stations. National Grid exceeded this goal five-fold, securing commitments from 1,500 charging stations. Now in Phase 2, the EV Make-Ready Team at National Grid is tasked with installing 16,000 charging ports by 2025. The ports will offer Level 2 and DCFC Fast Charging at public destinations, workplaces, retail shops, and multifamily dwellings as well as support fleet charging. Once completed, these charging stations will significantly reduce, if not eliminate, range concerns. It will provide EV drivers and fleet operators with access to charging facilities, thus making current and future EV adoption possible across the socio-economic spectrum.

National Grid is supporting fleets on their electrification journey. As the clean transportation ecosystem advances, early coordination between fleet operators and National Grid will ensure a seamless and cost-effective transition. (National Grid)

In addition, National Grid has launched its Fleet Advisory Services Program. This program performs fleet assessments across New York State to support commercial customers electrifying their fleets. The assessments help inform light, medium, and heavy-duty fleet operators about the benefits of fleet electrification. Cost breakdowns and a site feasibility analysis are provided to help fleet operators understand their options for converting to electric vehicles. Fleet assessments are available to municipalities, transportation and logistics companies, private commercial customers, as well as school districts. National Grid is also supporting the transit authorities in Buffalo and Albany to help electrify buses. Electrifying buses improves access to clean transportation for disadvantaged and vulnerable communities and supports healthier neighborhoods.

Finally, National Grid is testing a Medium and Heavy-Duty Vehicle Pilot program that provides charging infrastructure funding to eligible fleets that operate in New York's disadvantaged communities to create an equitable and impactful transition to a greener New York. National Grid is partnering with CALSTART and the New York State Energy Research and Development Authority Truck Voucher Incentive Program to make it even easier and affordable for fleets operating in these communities to purchase and lease eligible EVs.

National Grid is focused on tackling climate change challenges and providing energy solutions. We live in the communities we serve and are committed to improving our environment by accelerating the transition toward clean transportation and a carbon-neutral future that can benefit every New Yorker. To learn more about the program, please visit: https://www.nationalgridus.com/electric-vehicle-hub/

Leslie Vishwanath is part of National Grid's Electric Vehicle Make Ready Program Team. Leslie holds a BA degree in Policy Studies and an MBA degree in Urban Planning. Her background is in public program administration and she is committed to the equitable transformations of our environment by fostering sustainable growth and climate stewardship. ♻

Smart Driving Benefits Us and the Planet

Wayne Michaud

Smart driving, which is also known as eco-driving, green driving or just "driving more efficiently," is a method of driving that really matters because practicing it can have a positive effect for each one of us and the planet:

- Reducing CO_2 emissions that have an impact on our climate.
- Reducing fossil fuel consumption to keep some oil in the ground.
- Improving air quality and health.
- Making us safer drivers.
- Reducing the amount of money spent in fuel use and maintenance.

Fuel price sticker shock. (Casey Fiesler. Flickr)

We're going to focus mostly on the last point, because most drivers can best be swayed to change behavior when cost is involved. These days, as fuel prices at the pump have spiked mainly due to a war, people are saying, "Is this for real?" Smart driving can reduce costs whether a gallon of gas is $4.29 or $3.29, even if the vehicle is an inefficient gas guzzler. Case in point: nearly 50 years ago, when I drove a muscle car, the Arab oil embargo hit. As the cost of gasoline suddenly increased by more than 40%, I went from being an irresponsible street rodder to practicing what is now known as smart driving methods: going at or slightly under the speed limit, not accelerating hard uphill, and shifting gears up at lower RPMs. This resulted in squeezing 24 MPG out of a dyno-tuned 400-cubic-inch motor!

Here's how we save:

- Accelerate and brake smoothly. A great example of this is to "play the lights." An observant driver will notice when a traffic light has turned red a quarter mile or more down the road. Typically, drivers waste gas accelerating to the light and then using brakes more which increases brake wear. Instead, be a smart driver by getting into the habit of immediately taking your foot off the accelerator to coast toward the red light. Gas is saved as the car slows down some and brake wear is minimized. And then, sometimes, the light turns green before getting to the intersection. You've just won the "play the lights" game by not stopping to maintain some vehicle momentum! According to fueleconomy.gov, this practice will increase fuel economy by 10% to 40%.
- Watch your speed. We all know that speeding wastes fuel. With gas prices at an all-time high, increasing fuel economy by 7% to 14% by observing the speed limit is a bigger deal than ever.
- Avoid excessive idling. Prolonged stationary warmups, letting a car idle in a parking lot, or using drive-throughs can add to costs. From a compact car to a diesel pickup truck, idling unnecessarily for ten minutes a day can cost anywhere from $50 to $250 annually at today's fuel prices, not to mention the need of more frequent oil changes. Turn your key, be idle-free.

Additional money-saving tips while driving:

- Make sure tires are properly inflated; underinflated tires not only wear more quickly, but the increased rolling resistance can reduce fuel economy by 3% to 4%.
- Store a roof-top cargo box when not in use as it increases aerodynamic drag that reduces fuel economy anywhere from 2% to 25%, depending on speed.
- Clean junk out of the trunk; each one hundred pounds of extra weight reduces fuel economy by 1%.
- Set the air conditioning temperature higher in hotter weather to save up to 15% in fuel.

The big win of smart driving is that the above tips will not only save money but will also yield environmental and health benefits for us and for the planet. Increasing fuel economy equates to using less gas and oil, fossil fuels that result in reducing carbon emissions that impact our climate while at the same time reducing tailpipe toxins that impact air quality and our health.

And smart driving goes hand-in-hand with safe driving: complying with speed limits, conducting smooth acceleration and deceleration, avoiding jackrabbit starts, and avoiding tailgating. These defensive driving practices make drivers more aware of and attentive to the flow of traffic around and ahead of them and allows more reaction time to perform evasive maneuvers. Smart and safe.

Technological solutions to better achieve transportation efficiency and cleaner transportation, such as electrification, will gradually overtake behavioral ones to have a much greater impact. And when full autonomous driving hits its stride in the 2040s, smart driving won't matter much anymore.

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 California with a branch location in Vermont. Michaud headed Idle-Free VT in Vermont from 2006-2016. ♻

Multifamily Community Implements EV Charging

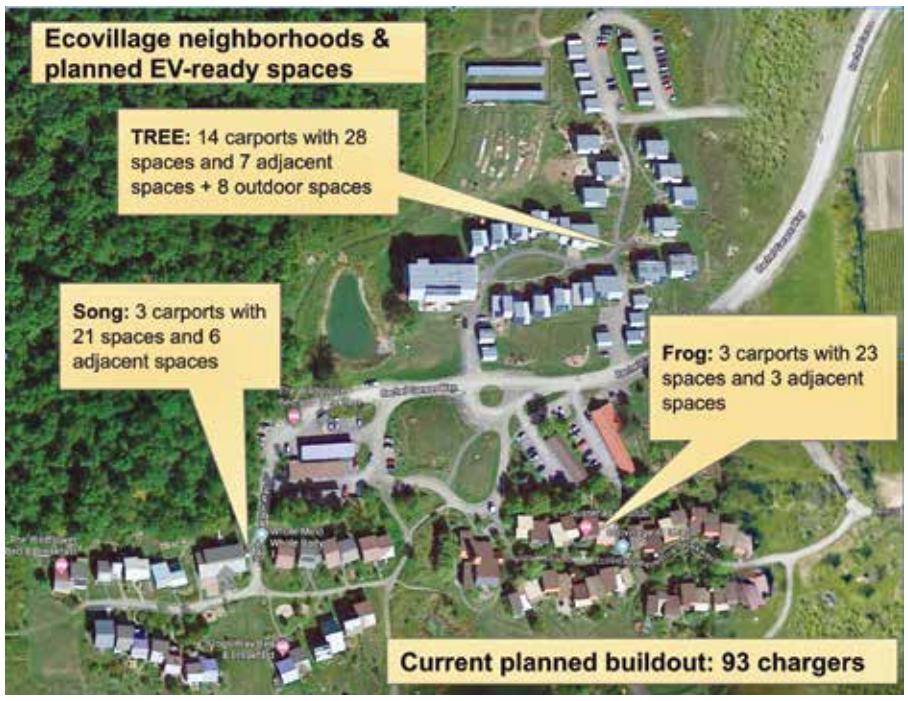
*Jeff Gilmore**

Worldwide we are in the midst of a big transition away from internal combustion cars and their network of gas stations to electric vehicles (EVs) and new arrangements for powering them.

This article addresses the challenges of adding chargers at scale to multifamily residential facilities where parking is not adjacent to each living unit.

Beginning and scaling up charging initially seems incredibly daunting. Most parking garages, carport structures and parking lots have very limited electric capacity. And it can be challenging to see how to make the economics of wiring, charger purchase and electricity costs work out.

Ecovillage at Ithaca (http://ecovillageithaca.org) has been working on scaling charging infrastructure to their 100 households since 2017, and has devised some strategies that have made EV buildout practical and reasonably cost effective.



Ecovillage at Ithaca, NY charging site diagram. Photos and diagrams © 2022 by Jeff Gilmore

Key Strategies

- Focus on installing 240-volt, charging-ready outlets, not chargers.
- Use daisy-chained wiring for charging circuits.
- Choose chargers with circuit-sharing capabilities.
- Standardize equipment by committing to one brand (manufacturer) of networked chargers.
- Plan ahead for scale

These strategies are linked – each depends on the others to make them workable.

Let's look at them one by one:

Installing 240-volt, charging-ready outlets

A useful goal is to have at least one parking space for each household pre-wired and ready to receive a charger. That means focusing first on how to provide the most 240-volt, 40-amp outlets using the financial resources and service capacity currently available.

Why is this helpful? Because it allows for much cheaper wiring strategies and avoids tying up capital in buying chargers today which may not get used for years if particular residents are not yet ready to purchase an EV.

Ideally these outlets should be in the parking spaces already assigned to residents, rather than set up for shared charging, as the resident experience is much more convenient and billing is simpler with dedicated chargers.

Daisy-chained wiring

The problem with typical charger wiring is that large, dedicated circuits are used for each charger, which needlessly ties up valuable electric service resources. For example, if a given garage building is served by a 100-amp circuit, then only two to three chargers could be installed in that entire building unless measures are taken to address that.

One of those measures is daisy-chained wiring. This means that, instead of each 240-volt outlet having its own circuit connected back to the electric panel, you connect five to ten outlets in parallel on the same circuit. Thus, to wire a set of adjacent parking spaces, you need only one home-run circuit to the electric panel and then short hops of wire from one parking space to the next. This reduces the cost per outlet significantly, and allows a small electric service to support many parking spaces.

Choose chargers with circuit-sharing capabilities

To make daisy-chained wiring work without overloading circuits, we need to use chargers that can communicate to dynamically limit charging rates. Such chargers allow for the creation of charger groups for which a total current limit can be configured, and generally require a network connection to make it work. When implemented properly, this feature continually adjusts the rate for all chargers in response to the coming, going and the completion of charge cycles of the vehicles.

It is important to remember that each EV does not need to refill its entire battery capacity each night; most cars daily typically drive 30 miles or less, so they only need a few hours on charge to top off. This can allow, for example, a 100-amp service to effectively serve at least 20 EVs.

Standardize on one brand of networked chargers

Selecting a particular brand of chargers which have the ability to communicate over a Wi-Fi network allows for a number of important benefits:

- Today, only chargers from the same vendor can perform the dynamic circuit sharing described above.
- Using the same vendor means that charging statistics from all chargers can be collected and downloaded in one place. This greatly facilitates billing.
- Maintenance people become familiar with their installation and operation.
- All chargers have the same capabilities, so policies and management are straightforward compared to a random mix of chargers.

The EnelX Juicebox product line is one example of chargers that support this strategy.

Plan for scale

This simply means, operate from the assumption that eventually most of your residents will need access to charging. Thus, you avoid taking shortcuts that work OK at first when there are only a few EVs but which become a major headache later on as EVs proliferate.

- Some examples of scale-related thinking:
- Seek to automate data collection. If you are doing billing for user-charging activity, choose equipment that can automatically accumulate such data in one location that allows for bulk downloading.
- If you are administering resident billing yourself, rather than using an outside network, craft clear policies that work at scale. Questions to answer include:
- Do you charge for power? If so, do you sell at cost or add a markup?
- How do you calculate energy costs and what aspects are included?
- Do you charge any session fees in addition to per-kWh charges?
- Do you charge any fees to fund ongoing maintenance of your charging infrastructure?
- Who buys the chargers, you or the residents themselves?
- Plan for growing electric service needs. This can mean thinking about how you do wiring today in ways that won't require (much) rework later as you need more capacity. Sometimes it means installing some conduits and wires you don't yet need if it is cheaper to do so now. It also means working with your utility company to

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MEET YOUR SOLAR INSTALLERS

In the February 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 are beginning our "Meet Your Solar Installer" series, from A to Z, starting with 603 Solar and Aegis Renewable Energy.**

Jessie Haas

603 SOLAR

603 Solar of Exeter, NH, was founded in 2018 by Sean Carlson, Zach Haithcock, and Scot Johnson, who worked with larger companies before going out on their own. The company serves Maine and New Hampshire, installing mostly grid-tied systems for both commercial and residential customers, and offers engineering, procurement, construction, and contracting services. They are not 'married' to any one solar module manufacturer but use several popular models.

The process begins with a site evaluation, including an assessment of yearly electricity use. Then the team puts together a scale model of the home and array so customers can see exactly what it will look like. 603 Solar submits the permitting paperwork, completes the installation, coordinates with state inspectors, and provides monitoring. They can always tell customers what the system is doing and can alert them if there is a problem. The company has installed 4,766 MW, including 1,799 kW in 2021. Haithcock says there have been many inquiries recently, as gas and utility bills rise. Supply chain issues are an issue, but they have not been forced to put any projects on hold. A recent project is installing the 48.8 kW array at the new New Hampshire State Liquor Store in Concord.

603 Solar also worked with the Solarize Canterbury project in the summer of 2019. The project met its goal twice-over, installing 35 new solar arrays in three months, with total installed kW of 340.4. The estimated year one production was 373,231 kWh, and total yearly avoided emissions was 264 metric tons. The Canterbury project was initiated by the town's energy committee, which put out a request for proposal and ultimately chose 603 Solar for the project.

Community solar. 603's approach to community solar differs slightly from that of many other installers. With most community solar projects, the ultimate cost depends on how many customers agree to convert to solar. In communities that are less ready to switch over, the cost can be higher. 603's community- based solar program, Solar Now, is more transparent up front. Cost is based on the number of panels each home or business needs. Customers can determine the cost of their system immediately. 603 notes on their website, "It also means we are putting our best foot forward right off the bat, instead of relying on other people switching in order to get a discount. The campaign generally lasts three months and anyone within the community that signs up during the campaign will be locked in at the special pricing. Throughout the campaign we work with the community to sponsor educational events, tabling events, advertising, and anything else that will help spread awareness of the campaign."

603 Solar installed a 16kW rooftop solar array at a residence in Madison, NH. (Courtesy image)

Though it is a New Hampshire company, 603 Solar offers financing through Vermont-based credit union VSECU. VSECU membership is normally only available to people who live or work in Vermont or are related to VSECU members, but they also extend membership to the Northeast Sustainable Energy Association (NESEA). 603 Solar customers wanting to finance through VSECU must join NESEA. Memberships cost $75 per year, with reduced rates for students, seniors, and professionals at the start of their careers. There are also business memberships starting at $300 per year for small businesses with one to10 employees, up to $1,200 per year for industry leaders.

Membership gives 603 Solar customers access to the VSECU no-money-down "VGreen" solar loan. This allows homeowners to start generating their own electricity without the daunting barrier of a large upfront payment. Tax credits and other incentives can be applied to lower your principal. Loans are at discounted, fixed rates. VSECU also offers a VGreen money market account, several types of energy loans, green vehicle loans, and even off-grid home mortgages.

According to Haithcock, VSECU was the only lender willing to have a discussion with them when they were starting their company. "We've cultivated a real relationship with them. We know everybody in the Green Loans Department." 603 has found VSECU excellent to work with, and though they could now go elsewhere, have decided to stick with the credit union that helped give them their start.

Zach Haithcock says the company has grown through being "honest, transparent, providing great customer service, and giving people the best ROI possible. Deep down I feel we're doing the right thing, helping people get a good product they can believe in. I get to meet people all the time, and I just love what I do."

AEGIS RENEWABLE ENERGY

Celebrating ten years of helping businesses and municipalities build a clean solar powered future

For Aegis Renewable Energy (www.aegis-re.com), founder and CEO Nils Behn, a native of Vermont's Mad River Valley, it all began in a tenth grade anthropology class about indigenous people in the Amazon. Those people, he realized, had lived all those thousands of years in their environment, and the enivronment had thrived with them in it. The contrast with our civilization's impact on the environment was stark.

Then and there, Nils said, he made a pact with himself, "Whatever I ended up doing, I wanted to have a net positive for my existence, my time here on the planet. That's very much part of the ethos of our company."

After studying anthropology in college, Nils worked for a nonprofit, then moved to Idaho with his girlfriend, now wife and partner Sonia. The couple built a solar, off-grid strawbale house an hour and a half from the nearest town (population 100). They moved back to Vermont after having their son. Nils worked as a Senior Project Manager for Northern Power systems for nine years where he gained broad experience in commercial and military solar manufacturing and installations. He then ran the wind division of Alteris Renewables. After Alteris merged with RGS Energy, Nils spun the division off into Aegis Wind LLC, now Aegis Renewable Energy, Inc., based in Waitsfield, Vermont. Sonia Behn is the financial controller for the company, and as a woman leader in the construction and renewable energy sectors, works to support women in those industries. She served on the board of the Amicus Solar Cooperative (www.amicussolar.com) which is a member-owned co-op of 68 solar installation companies throughout the U.S. and Canada.

Amicus Solar Cooperative provides Aegis and its other members access to equipment and components at prices typically reserved for only the very largest solar companies in the country. This advantage allows Aegis to

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Chroma Technology Reduces Expenses and Carbon Footprint

George Harvey

Chroma Technology was founded in 1991 as an employee-owned company to manufacture optical filters for a variety of scientific purposes. Its products are used for purposes ranging from biology to astronomy and machine vision. It is a B-corp. It has over 100 employees, and is located near Bellows Falls, Vermont. It also has offices in Germany, Japan, and China.

Chroma Technology built its current facility in Rockingham Vermont (the municipality that includes Bellows Falls) in 2003, with a view to energy efficiency and conservation. The investments made in energy efficiency for the new facility helped save the company 475,000 kilowatt-hours (kWh) of electricity and 6,000 gallons of propane per year, reducing its carbon emissions by over 75 tons each year from propane savings alone (https://www.chroma.com/company).

Now, Chroma Technology has gone further toward sustainable operation. It partnered with Green Lantern Solar, based in Waterbury, Vermont, to build a solar array near its manufacturing plant. The new array has 1870 solar modules and a capacity of 500 kilowatts, which is enough to provide about 950,000 kWh of electricity per year. The electricity will be sufficient to offset about 800,000 pounds of CO_2 each year. That is the equivalent of taking almost 150 cars off the roads.

"As a Certified Employee-Owned B Corporation Chroma is committed to sustainable and socially responsible business practices," Chroma Technology CEO Newell Lessell said. "This new solar array will enable us to significantly reduce our carbon footprint even as our business continues to grow."

The new array will reduce the energy expenses for Chroma Technology by about a third. The company is still considering options for reducing its carbon footprint further. It is also a growing business with a worldwide presence, so we can expect more progress from it in the future.

Green Lantern Solar installed the 500-kilowatt ground-mount solar array for Chroma Technology. It is projected to produce enough energy to offset one-third of Chroma's annual energy expenses. (Image: Green Lantern Solar)

"This array will reduce Chroma's operating expenses and have a real impact on its sustainability goals," said Weston Martin, Green Lantern Solar's Director of Sustainable Partnerships. "We're gratified to work with companies like Chroma who are taking real steps to demonstrate how costs savings and a clean energy future can be achieved."

The current array is operated under a virtual net-metering system. It was developed and built by Green Lantern Solar, which will own and continue to operate it. The Chroma Technology array is just the latest project from Green Lantern Solar, which has already developed over 56 megawatts of solar projects in Vermont. Green Lantern Solar offers turn-key commercial solar projects for educational, healthcare, and government organizations. It has specialized in development at difficult sites such as brownfields, landfills, quarries, and other challenging properties. Its services include development, financing, construction, operations, maintenance, and asset management.

The Chroma Technology website is www.chroma.com.

Green Lantern Solar's website is www.greenlanternsolar.com. ♻

AEGIS RENEWABLE ENERGY

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provide project pricing that is extremely competitive.. Aegis is also a member of the Amicus O&M (Operations and Maintenance) Cooperative (www.amicusom.com) which collectively provides ongoing maintenance services for the growing number of solar PV systems throughout the U.S. Aegis' skilled service technicians allow the company to extend its valued relationship with its customers into the full life cycle of the solar project and ensures consistent coverage and standardized services for their customers.

Above: Aegis Renewable Energy installed this 369.9kW solar array in St. George, Vermont. Left is the 129.5kW solar array at Laurentide Housing in Burlington, VT that they also installed. (Courtesy images)

Aegis currently works only on commercial and utility scale solar and energy storage projects, including rooftop, carport, and ground-mounted projects. They provide what the company calls "a suite of design-build services that encompass every step in renewable energy project development from feasibility and site analysis, complete engineering, procurement, and construction (EPC) services to final commissioning and maintenance." They have installed 40MW since 2011, with a strong pipeline of projects for 2022 throughout the Northeast.

On bigger projects, supply chain is becoming a real issue. "Lead times have gotten crazy," Nils Behn says. One utility recently announced very long lead times on some critical gear for connections which are not projected to be delivered for a jaw-dropping 92 weeks. The phone is still ringing about new projects, though.

Aegis projects you might see while out and about include Lawson's Finest Brewery, Richmond Creamery, Vermont Creamery-Ayer's Brook Goat Dairy Farm, Manchester, New Hamphire's Landfill, and Vermont community or town installations in Waitsfield, Warren, Colchester, Mad River, Barre, Lyndonville, Londonderry, Saint Albans, and Sudbury. Colchester installed two 150kW projects through Aegis, both on town land, which now produce an equivalent of 70% of the electricity used to provide municipal services. The projects save the town over $1 million after repayment of capital and operating costs. A third project is in the works.

In many cases the Renewable Energy Credits (RECs) for a project are retired, rather than being sold to out-of-state polluters, for a much higher environmental benefit.

The company website makes it clear what is at stake. "Every solar panel that we install means that 50 lightbulbs can be turned on without dependence on the fossil fuels that are responsible for the rapid destabilization of our planet's climate. Every solar panel we install means that we as parents are actively working toward a future that we can be proud to hand over to our children." Or as Nils Behn puts it, "Our focus on helping our customers achieve their renewable energy goals comes from our desire to do good in the world."

Jessie Haas is the author of over 40 books, including The Hungry Place. *She and husband Michael Daley have lived in a tiny, off-grid home in Westminster for 38 years.*

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

Green Power Series:
Solar Farms in the Northeast

Part IV: Leadership and Creative Thinking Reshape the Solar Farm Landscape

Toby Martin

Green Energy Times has published three articles in its Green Power Series that focused on a number of solar farm companies located in Maine, New Hampshire, New York and Vermont. Drawing from those articles, this article underscores a set of emerging environmental practices that are becoming increasingly important in the solar farm industry, and characterize the leadership qualities among its developers.

Gardens under solar panels in Boulder, CO produced more than 8,000 lbs of produce, while the panels above generate enough power for 300 local homes. (Kirk Siegler/NPR) (https://n.pr/3712BXc)

In 1970, the U.S. established the Environmental Protection Agency (EPA), and 25 years later, in 1995, the EPA created the Brownfields and Land Revitalization Program to clean up and return targeted toxic land areas to safe and productive reuse. Unfortunately, the EPA estimates more than 450,000 U.S. brownfields still remain. Solar farm developers have joined forces to collaborate and meet that challenging problem with efforts to take strong, environmentally positive action to reclaim brownfield sites.

In *G.E.T.'s* February 2022 issue, it was reported that Manchester, New Hampshire reclaimed its 12-acre municipal landfill and installed an 8,000-panel solar array. The project led to a newsworthy visit by U.S. Secretary of Energy Jennifer M. Granholm last September, when she commended them and the city's leaders for their collaborative environmental project work.

G.E.T. also reported how we were struck by the environmental consciousness of Cipriani Energy Group in its New York solar farms, because they have adopted plans to transition from mechanical mowing practices and replace them with grazing animals like sheep and alpacas. Cipriani will interplant their ground-mounted solar farm arrays with native flowering plants that will attract pollinators.

In Maine, Massachusetts, and New Hampshire, ReVision Energy's goals and efforts demonstrate their respect for ecologically positive land use. They locate their solar farms on land that does not conflict with environmentally important uses like farming or forestry, such as their Long Pond project on Maine's Mount Desert Island, where they restored and sited the solar farm on a previously decommissioned and unserviceable landfill.

A flock of sheep is grazing on a solar farm. This is an ideal combination, as the sheep keep the grass short and the solar panels provide shelter for the flock. (Photo: Evelyn Simak)

ReVision's co-founder, Phil Coupe, recently wrote an inspiring piece published in the company's newsletter, which captures the essence of the ecological spirit and philosophy of what is possible for best practices in solar farm site design and management.

Coupe's essay reflects that ethic, and demonstrates what is possible with thinking that exemplifies creative, innovative, and imaginative corporate leadership. It focuses on agrivoltaics, which makes it possible to integrate solar generation with agriculture, and which solar farm leaders in the Northeast have been adopting.

Coupe's piece echoed the need for environmentalism in the solar industry. It underscores the exemplary work of Colorado farmer Byron Kominek, who created Jack's Solar Garden, installed by fellow B Corp and (Colorado) Amicus member Namaste Solar, to "increase food and renewable energy production and to see if the 'dual use' approach of agrivoltaics can help improve food and energy security," according to Coupe.

Coupe added, "Based on early results from Jack's Solar Garden, and from ongoing research worldwide, agrivoltaics (dual use farming) has immense potential to alleviate some of our worst problems. According to the 2021 report "Dual Use, Dual Value Solar Agrivoltaics Power Farm Economics," by Dr. Maggie Teliska and Michael P. Totten, just 1% of existing cultivated agricultural lands installing agrivoltaic microgrids could meet worldwide energy demand."

He continued by citing "Agrivoltaics: Producing Solar Energy While Protecting Farmland" by Bill Pederson and Brooks Lamb, which shows how "the dual use approach can dramatically increase land productivity." The proof? Kominek produced 8,600 pounds of produce by planting seeds between the rows of his farm's solar panels in 2021.

Coupe concluded," Food production and energy generation have long been viewed as incompatible on the same patch of earth, if not mutually exclusive. The successful proof of concept that is Jack's Solar Garden, along with solar grazing initiatives, has debunked the notion that clean, zero-emission solar energy production conflicts with farming. While crops can grow robustly between rows of solar panels, it turns out that livestock are the ideal 'lawnmowers' for ground-mounted solar arrays, because they keep vegetation from growing tall enough to shade the panels."

All of these positive initiatives taken by solar farm management teams in the Northeast and farmers like Kominek in Colorado show that solar farms are increasingly aware of, sensitive to, and acting on environmental issues. And they can and do contribute to diversifying food production yields, environmentalism, and to promoting and protecting positive land use, biodiversity, clean air, clean water, and regional native species.

Toby Martin lives in Islesboro, ME, where he works locally and statewide to strengthen Maine's clean energy sustainability. A founding member of the Islesboro Energy Team and the Islesboro Energy Committee, he also coordinates the Islesboro Energy Conference, and contributes to Green Energy Times *as a writer and founding member of its Maine distribution team.* ♻

Coos County NH Communities Vote for Clean Energy

Sam Evans-Brown

This year during town meeting season, five Coos County (NH) communities approved funding for solar and energy efficiency projects which combined will result in over a half a million dollars in energy savings over their lifetimes, and leverage as much as $340 thousand dollars in grant support.

A 15kW solar array installed on the Shelburne town hall in collaboration with Clean Energy NH. The solar array offsets all of the electricity consumed annually by the town hall. (Photo: Melissa Elander)

- The Town of Whitefield voted unanimously to replace and insulate the roof of their fire station, and put solar arrays on the roofs of the fire station, library and town buildings, totaling 66 kW in generation capacity.
- Franconia voted to install an 18.2kW ground mounted solar array behind their town hall.
- Randolph set aside $20,000 for an energy efficiency capital reserve fund to improve the energy performance of municipal buildings.
- The Gorham-Randolph-Shelburne Cooperative school district voted to fund a 124kW ground-mounted solar array to help offset the electrical bills of the Edward Fenn Elementary School.
- The Town of Gorham voted to create a $10,000 capital reserve fund to install solar on municipal buildings.
- The Town of Stratford voted to install a 50kW solar array at the town transfer station, after having already installed a 20kW array at the town hall in 2021.

In all, these projects are expected to generate more than six million kilowatt hours of clean electricity for these communities over a 25-year period. The energy savings will not only reduce the local municipal energy bills but also push down regional wholesale electricity prices whenever the arrays are generating power.

"We are excited to be a part of the solution and hope we get the grant," said Gorham Randolph Shelburne Cooperative School District Superintendent David Backler.

The North Country Circuit Rider Program

These are just the latest projects that have been helped across the finish line by Clean Energy NH's North Country Circuit Rider, Melissa Elander, who offers technical assistance—free-of-charge—to Coos County towns that want to deploy clean energy and reduce their energy bills. "These votes are representative of the momentum that is building in the North Country," said Elander. "Towns are seeing they can save on their municipal budgets by investing in these projects."

The Circuit Rider program is funded by the Neil and Louise Tillotson Fund and has recently announced that it will be expanding its offerings with a second position, the Community Energy Coordinator. This new position will offer free technical assistance to small businesses that want to reduce their energy.

The Circuit Rider concept is simple, but powerful. We at Clean Energy NH simply connect towns and businesses to existing programs and help them access funds that are already available. It's a program we can and should be offering all throughout New Hampshire, and we are currently seeking funding by adding more circuit riders covering different parts of the state.

The North Country Circuit rider program began in 2018, and has helped communities complete over two dozen projects, which have attracted over a half a million dollars in competitive grant funding and are saving those communities over $150,000 a year in energy costs.

Towns or small businesses interested in engaging with the Circuit Rider program should contact Melissa Elander via email at melissa@cleanenergynh.org.

Sam Evans-Brown is the Executive Director of Clean Energy NH. ♻

NY Community Solar Market

Cont'd from p.3

with clean, renewable energy, subscribers receive a credit on their electric bills for their portion of the solar system's output.

Community solar made up 70% of total solar installations across the state in 2021. In addition, NY's distributed solar pipeline is now comprised of more than 708 of these projects totaling 2,300 MW, which once completed will help expand access to clean energy for all NY-ers, including low-to-moderate income (LMI) households and those living in disadvantaged communities (DACs) (https://on.ny.gov/3LjpQdz). This pipeline is complemented by 73 NYS-supported utility-scale solar projects under development throughout the state - together, these projects will deliver enough electricity to power more than 2.2 million homes once completed. The State's success in deploying community solar is confirmed by the Solar Energy Industry Association and Wood Mackenzie Solar Market Insight 2021 Year in Review report (https://bit.ly/US-Market-Insight), not only ranking NYS as the all-time national leader ahead of second-place Minnesota, but also highlighting the Empire State as number one in 2021 for installations - more than double second-place state Massachusetts.

The achievement of this milestone has been underpinned by robust support from NYSERDA's NY-Sun program, the State's signature $1.8 billion initiative to advance the scale-up of solar while driving costs down and making solar energy more accessible to homes, businesses, and communities. Currently, installed distributed solar projects, combined with the projects that are under development, bring the State to 95% of the current Climate Act goal to install 6 GW of distributed solar by 2025.

Since 2011, NY-Sun has helped:

- Support the installation of solar on the rooftop or property of 165,000 homes or businesses spanning every county in NYS;
- Provide over $1.3 billion in incentives, leveraging $6.1 billion in private investment;
- Drive over 2,500% solar growth in the State;
- Facilitate the delivery of enough clean, renewable energy to power over 627,000 NYS homes;
- Foster 12,000 jobs in the solar industry;
- Reduce the cost of solar 70% in 10 years; and
- Ensure over $200 million is dedicated to low- to moderate-income (LMI) households, affordable housing, and disadvantaged and environmental justice communities as part of its Solar Energy Equity Framework.
- Last fall, Governor Hochul called for an increase to NY's solar goal to 10 GW by 2030. To accomplish this goal, NYSERDA and the Department of Public Service filed a roadmap (https://on.ny.gov/3Lh9K4a) with the Public Service Commission to expand the state's successful NY-Sun initiative into one of the largest and most inclusive solar programs of its kind in the nation, including continuing incentives for an additional 2,270 MW of community solar projects, enough to power an additional nearly 400,000 homes. The roadmap also included ambitious targets for projects located in the downstate region and dedicated incentives for community solar projects service DACs and LMI subscribers, consistent with the Climate Act's call for at least 35%, with a goal of 40%, of the benefits of clean energy investments be directed to disadvantaged communities. The roadmap also proposes prevailing wage requirements for solar projects greater than 1 MW within the NY-SUN program to promote the continued growth of high-quality solar jobs. ♻

NEW TECHNOLOGY: NEW CHOICES FOR ENERGY STORAGE

George Harvey

Our least expensive and least polluting forms of electricity generation happen to be intermittent or variable. We can bring them up to being highly reliable, highly responsive forms of energy by the simple addition of energy storage. But a question arises about what sort of energy storage we should use.

Highview Power cryogenic power plant for Vermont. (Courtesy image)

The answer to that question is not a problem because of a small number of difficult choices. It is quite the opposite. There is a huge number of choices, probably more than most people would care to count. In many cases, the question will arise only to find which of several choices is best. And there is a lot of research being done, so the situation is changing rapidly. Here is a look at what is new.

Batteries are only one type of choice. There are systems that involve gravity, including pumped hydropower and others. There are big flywheels to provide the grid with a quick power boost. Chemicals can be made and then used to generate power, hydrogen being one example. Compressed air is another choice with surprising potential. Energy can be stored as heat. And all of these are in use today for large-scale applications, and almost all of them are undergoing further development. Other technologies that are already used for smaller situations are also being developed for large ones, and capacitors are an example. Let's look at some of these, and how they are being developed and improved. Please note that this list just touches on the subject, which is the object of intense scientific development worldwide.

Batteries

Rechargeable batteries have been around for a long time. Lead-acid batteries were invented in 1859 by Gaston Planté, a French scientist. Since that time, many more rechargeable battery types have shown up.

Today, a lot of the attention on batteries is focused on lithium-ion and lithium-iron phosphate batteries. The question of cobalt has been largely solved, from a technical point of view. But there are questions about the availability of lithium and environmental damage in extracting it.

One example of efforts to address a potential lithium shortage is to produce lithium by extracting it from sea water. Lithium compounds tend to be very soluble in water, so over the millennia most of our lithium has wound up in the ocean. Recent research shows that the concentration of lithium in the water can be increased from 0.2 parts per million (ppm) to 9,000 ppm at a cost of only $5 per kilogram of lithium, making it very worth extracting. The study on this was published in the journal *Energy & Environmental Science* (https://rsc.li/3qlOBHW).

Another approach is the sodium-ion battery, which does not use lithium at all. Part of the problem with sodium is that the atom is much larger and heavier than lithium, so the batteries are bigger also, possibly preventing their use in road vehicles. On the other hand, sodium-ion batteries promise to be much less expensive than lithium-ion batteries, because sodium is so very abundant. Also, sodium batteries will probably be very safe. The work on such systems is underway in many places. An article at Wikipedia covers the subject (www.bit.ly/Sodium-batteries). Other batteries, such as potassium-ion, also show potential.

Flywheel for energy storage. (NASA image, public domain)

Yet another battery technology worth mentioning is iron-air. These batteries produce power when iron in them rusts. They can be charged by applying electricity that converts the rust back to iron. The fact that the material in use is iron makes these batteries very inexpensive, non-toxic, and safe. A company in Sommerville, Massachusetts, Form Energy, has been developing such systems and is now installing its first system, a one-megawatt (MW), 150 megawatt-hour (MWh) battery in Minnesota. A second system, at 15-MW, 1,500 MWh is being designed for Georgia Power. These systems are expected to reduce to an "ultra-low cost" compared to that of lithium-ion systems, according to an article in *Greentech Media* (www.bit.ly/Form-Energy-battery).

Flow batteries are very different. In them, solutions flow past each other, usually with a membrane between them. Electrons go through the membrane, allowing the battery to charge or discharge. Flow batteries tend to be too big for use in vehicles, but they have numerous advantages. There are many types, and a lot of work is being done to develop them. The article at Wikipedia may be helpful for those who want to know more (www.bit.ly/Flow-battery).

Gravity

There are several types of gravity storage systems. The one that has been getting attention in the news lately was developed by Energy Vault. This system has a tower with apparatus for lifting very large, heavy blocks to some height. When power is needed, the blocks are allowed to go back down, generating electricity as they do. A recent article in CNN explains this further (www.cnn.it/3Nxnd9A).

Chemicals

A lot of work is going into what is called "green hydrogen." Most hydrogen is currently made using natural gas or coal, but green hydrogen is made by hydrolysis of water using renewable energy. Hydrogen can be used in a number of ways to create electricity or be used for fuel, but it is also important as a chemical. Some green hydrogen projects are intended to replace natural gas. A post at Rethink Technology Research says Fortescue Industries, an Australian industry giant, pledged to put up $50 billion Australian ($32.5 billion US) to replace one third of the UK's natural gas with hydrogen (www.bit.ly/Replace-natural-gas).

Heat

We should consider heat for storage. Energy has been stored as heat for conversion to electricity later for some time. A lot of research is being done to use heat as much as months after it is stored. We might feel that this technology is still young. An article on the subject is in Wikipedia (www.bit.ly/Wiki-thermal-storage).

Compressed air

There are different ways to store energy by compressing air. One is to compress it to the point that it liquefies, then boil it to turn turbines, using just ambient heat. Highview has a project underway in Vermont to do just that. An article in Energy Storage News says that Highview has raised $70 million to build such projects, including one in northern Vermont (www.bit.ly/Highview-Vermont).

The cost of storing energy is declining rapidly. As it does, more options are becoming available. ♻

Derry, New Hampshire Contracts for 2.2 MW Solar On Closed and Capped Solid Waste Landfill

George Harvey

Derry, NH will build a 2.2 megawatt (MW) solar array on a solid waste landfill that the town had closed and capped in 1998. (Image: Derry Net Zero Task Force)

The Town Council of Derry, New Hampshire, has signed contracts for a 2.2 megawatt (MW) solar array to be built on a solid waste landfill that the town had closed and capped in 1998. The town owns the land, but because of its prior use, almost nothing can be built on it. A solar array turns that nearly useless land into a community resource and will also reduce carbon emissions by over 2,555 tons per year. The power generated by the solar project will be fed into the Town of Derry's waste and waterworks facilities, where part of the electricity will be used. The remainder of the electricity will be exported to the grid and the town will be compensated for it by the local utility. The site still has potential to expand in the future.

The contract for the array was awarded to Encore Renewable Energy, of Burlington, Vermont. Encore will undertake nearly all of the necessary work to get the array built, including financing, design, construction, installation and operation. The project will be designated as Derry Solar, LLC.

The array will come with no upfront cost to the town. Nevertheless, it is projected that it will save the town $3.5 million over the term of the 25-year contract. That indicates a saving of about $140,000 per year, which is a substantial benefit for the town.

Recently passed Federal legislation announced by Senator Jeanne Shaheen (D-NH) will support economic development and infrastructure projects across New Hampshire and accelerate installation of clean energy systems for communities to reduce energy expenses and meet sustainability goals. It's anticipated that $500,000 will be provided to support the Derry Solar Project, helping further reduce the cost per kilowatt-hour about 10%, thus saving the town about $4 million over the Power Purchase Agreement contract's lifetime (www.bit.ly/Derry-landfill-solar).

At 2.2MW, erected on seven acres of the 10-acre landfill site, the array will be one of the largest in New Hampshire. It will also set the town ahead of its schedule of having a net-zero renewable electric supply. The Town of Derry had a goal of getting to net-zero by 2025, but it now appears that it will be achieved about two years early, with this Derry Solar Project operating in late 2023.

Work on the specifics of the array was begun by the Net Zero Task Force over two years ago, though the group was started several years previously. The group includes engineers, business people, energy experts, and members of the public. Key organizations that have representation are schools, the Department of Public Works, the Planning Board, Code Enforcement, the Conservation Committee, and Economic Development.

The work done by the Net Zero Task Force was extensive. It had to coordinate communications with the people in the community, while supporting state legislation. It also had to get a buy-in from Governor Chris Sununu.

"Moving forward with this solar project is a major win for our community and our state," said Joshua Bourdon, Derry Town Councilor-at-Large and founder of the Net Zero Task Force. "I ran for re-election with a promise to reduce our taxes while maintaining services through creative solutions. Achieving Net Zero Energy through the efforts of the Task Force and Derry Public Works Department contributed to that creative solution."

Council Chairman Jeff Moulton added, "This project is the culmination of six years of planning and engineering work performed by the volunteers of the Net Zero Task Force. In advance of this project, the Task Force benchmarked the energy use of all 40 town and school buildings, implemented a number of energy initiatives that are currently saving the town over $900,000 per year, and in 2018 installed an 86-kilowatt solar project at the town's transfer station, currently performing above its expected output."

A competitive request for proposals was solicited by the Town of Derry in September of 2021. Seven companies submitted proposals, and Encore Renewable Energy was chosen from among them. Encore has also had considerable previous experience with brownfield and landfill development. Over a period of ten years, it has installed over 17MW of solar capacity on nine projects of this type.

"Encore provided the best value power purchase agreement proposal for the town," according to Mike Fowler, Executive Director, Derry Public Works. "As a future partner, Encore brings experience and technical expertise to successfully develop this type of project. The favorable economics and experience with landfill solar development were the most important factors in awarding the contract to Encore."

Chad Farrell, CEO and Founder of Encore Renewable Energy, said, "Tapping into the opportunity for sustainable energy development on under-valued properties like landfills is part of the DNA of our company," said. "We're excited to bring our deep expertise in the reuse of landfills as host sites for community-scale solar arrays to Derry to help support the community's transition to the clean energy economy." ♻

SUN-DAY CAMPAIGN NEWS

U.S. Renewable Energy Production In 2021 Hit an All-Time High

Washington D.C. - Domestic production and consumption of renewable energy (i.e., biofuels, biomass, geothermal, hydropower, solar, wind) reached an all-time high in 2021, according to a SUN DAY Campaign analysis of new data released by the U.S. Energy Information Administration (EIA).

The latest issue of EIA's "Monthly Energy Review" report (with data through December 31, 2021) reveals that renewable sources accounted for more than one-eighth (12.61%) of the U.S. energy produced and 12.49% of the energy consumed for electricity, transportation, heating, and other uses. Renewable energy production during 2021 was 12.317 quadrillion Btu (quads) - 5.39% more than in 2020 and 5.89% more than in 2019.

A sharp drop in hydropower (down 8.79%) was more than offset by growth in all non-hydro renewables: solar energy (up 23.84%), wind (up 12.38%), biofuels (up 7.52%), geothermal (up 1.48%), and biomass (up 1.00%).

Wind is now the largest single renewable energy source, accounting for 27.05% of total U.S. renewable energy output, followed by biomass (21.41%), biofuels (19.15%), hydropower (18.54%), solar (12.19%), and geothermal (1.67%).

By comparison, production by the nation's nuclear power plants in 2021 dropped by 1.48% and 3.82% compared to 2020 and 2019 levels. As a consequence, energy provided by renewable sources in 2021 exceeded nuclear generation by more than 50% (12.317 quads vs. 8.129 quads).

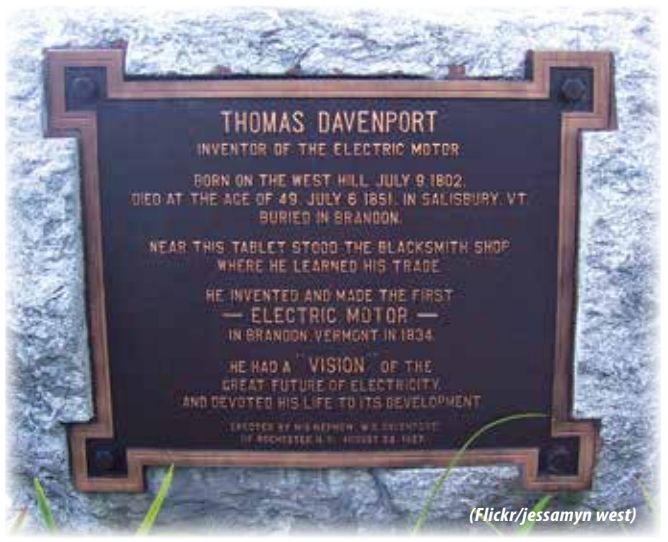
Renewables energy production last year also surpassed that of coal by 6.54% (12.317 quads vs. 11.561 quads). While energy produced from coal increased over its 2019 level (10.703 quads), it was still less than any prior year going back to the early 1960s.

However, domestic energy production from all fossil fuel sources combined (i.e., oil and natural gas as well as coal) increased by 2.03% and accounted for 79.08% of the total. That, in turn, contributed to a 6.12% increase in carbon dioxide (C02) emissions attributable to U.S. energy consumption.

"The continued expansion of renewable energy's share of U.S. energy production and consumption is encouraging," noted the SUN DAY Campaign's executive director Ken Bossong. "However, EIA's latest data provide a clear warning that the pace of that growth must accelerate rapidly if we are to avoid the worst consequences of climate change." *(Links available online)* ♻

Brandon, Vermont THE BIRTHPLACE OF ELECTRIC POWER

Kevin Thornton

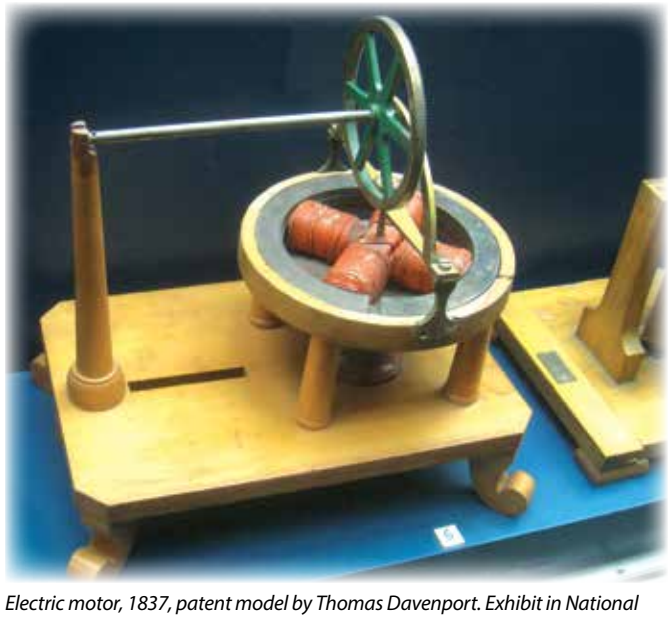


(Flickr/jessamyn west)

In February 1837, Thomas Davenport of Brandon, Vermont was awarded the world's first patent for an electric motor. The time has come for us to celebrate his achievement as a landmark in technological history, because it was. The Town of Brandon and the Brandon Museum are working in concert to make that celebration happen.

An electric motor is any device that uses electric power to create mechanical motion. The electric motor is one of the most important inventions of all time, ranking with the internal combustion engine and the transistor as devices that improve all of our lives, every day. We rarely think about electric motors, because they are so common and so reliable that we take them for granted.

In your kitchen your refrigerator uses an electric motor. So does your dishwasher. So does your microwave. Have a coffee grinder, food processor or mixer? They use electric motors. Have a heat pump, air conditioner or a few fans in the house? They use electric motors, too. Your hair dryer uses an electric motor. Perhaps your toothbrush does as well. Every electric tool in your basement or shop is powered by an electric motor. Your washing machine and clothes dryers run on electric motors. Your car has as many as forty electric motors in it, in the windows, door locks, climate control system, windshield wipers, and seats. Every computer in your house has one. How about that phone in your pocket? It vibrates because of an electric motor.


Electric motor, 1837, patent model by Thomas Davenport. Exhibit in National Museum of American History, Washington, D.C. (Wikimedia/Daderot)

Every day of your life you benefit from Davenport's invention forty or fifty times. (That's a conservative estimate.) Multiply that by billions of people, and you get a sense of the magnitude of his invention's impact on the world.

Davenport first got the idea that changed history when he witnessed an electromagnet at work in 1833. Electromagnets themselves were very recent inventions (the first one had been invented in England only in 1821). By 1834, with the help of his wife Emily and her cousin, Orange Smalley of Forestdale, he had successfully built a functioning motor. By the end of 1835, he had demonstrated the invention to a series of the leading men of American science. By 1836, he had perfected a vastly improved motor and become the second person in the world to apply electricity to transportation, building a model railroad that proved electric-powered travel was possible.

In February 1837, he was awarded his U.S. patent. In August 1837, he was awarded a British patent. The British patent is significant because Britain was by far the most industrialized country in the world at the time. Davenport's patent there is proof of his belief in the industrial potential of the motor.

Davenport demonstrated his motor in New York in 1837. The New York Herald proclaimed his invention "The Dawn of a New Civilization" while the New York Evening-Star called it "the application of an entire new and immeasurable agent of mechanical power."

The electric age had begun. Over the next few years, mostly divided between New York and Brandon, Davenport built over 100 motors, continually innovating and improving prior designs. Among them was a motor powered entirely by electromagnets, an innovation which greatly increased the device's rotational speed and power. In 1840 he built a reciprocating motor that powered the world's first electric printing press, on which he printed his short-lived journal, The Electro-Magnet and Mechanics Intelligencer.

Given all that, why isn't Davenport's name as well-known as Henry Ford's or Thomas Edison's? The short answer is through a combination of bad luck and bad timing. Davenport was ahead of his time in more ways

Cont'd on p.15

The Green Mountain State's Electricity Isn't So Green

Peter Sterling

Vermont's electric sector is estimated to contribute only 2% of our climate-change-causing greenhouse gas emissions- seemingly insignificant compared to the whopping 74% of emissions coming from our transportation sector and from heating and cooling our homes and businesses.

But this 2% figure is quite deceptive and masks the level of pollution that comes from our electricity especially during the winter when Vermonters are quite likely using energy from fossil fuels such as natural gas and increasingly, oil and coal.

After the cold snaps during the winter of 2017-18 drove up the price of natural gas used for heating, "winter reliability" rules were enacted New England-wide so that electric power plants could switch quickly from gas to oil when the temperature dropped, and more natural gas was needed for heating and less was available to run power plants.

And that is why, on average during the run of cold weather this past January, roughly 13% of the electricity mix Vermont purchased from the New England electric grid was fueled by burning oil and coal.

So, what can be done to reduce the amount of coal, oil and natural gas used to generate the electricity we rely on for our everyday lives? For starters, the cleanest energy source is the one not used- meaning that by weatherizing our homes and putting in efficient heating systems powered by renewables, we can avoid using dirty power that accelerates the climate crisis.

But it is important to note that, as Vermont works to move away from fossil fuels and towards electricity to power our cars and trucks and to heat our homes, we must ensure this electricity comes from renewable sources such as wind and solar. Current law in Vermont calls for 10% of all electricity to be generated from in-state renewables by 2032. When the law was created in 2017, this seemed like a reasonable goal to combat climate change.

But the climate change crisis is accelerating faster than most scientists had anticipated. Our laws must evolve, too. The Vermont Legislature must act by doubling or even tripling the amount of renewable electricity Vermont generates within our borders.

If we don't act soon, all of the good work we are doing to "electrify everything" to reduce greenhouse gas emissions will be simply replacing the fossil fuels we now use for home heating and running our vehicles, with fossil fuels used to power electric power plants.

Fortunately, important components of the solution are already in place. Vermont has a vibrant clean energy industry, which though declining in recent years, employed just over 19,000 Vermonters in 2017 representing just over 6% of the state's workforce. And, we already have a cost effective statewide program, called net metering, in place to help make installing solar power more affordable for Vermonters.

Renewable Energy Vermont commissioned a study on the New England-wide impacts of solar programs like net metering. The study examined data from 2014-2019 collected by the U.S. Environmental Protection Agency and found that solar power helped avoid 4.6 million metric tons of carbon dioxide emissions and avoided millions of pounds of criteria pollutants proven to have negative impacts on human health contributing $87 million in public health benefits and another $515 million dollars in climate benefits in addition to providing a clean and renewable source of electricity for tens of thousands of people regionwide.

Since wind and solar output tend to peak at night and day respectively, they are highly complementary clean energy resources. (Image: alcse.org)

While the amount of solar power we produce grows every year, deploying wind power has lagged well behind, held back by an unsupportive Governor, a small but vocal group of NIMBY activists and a regulatory process with the strictest wind sound rules in the nation. Since wind and solar output tend to peak at night and day respectively, they are highly complementary clean energy resources. Finding a way to bring wind power back to Vermont will be essential to displacing fossil fuel generated electricity.

Thanks to the Legislature's override of Governor Scott's veto of the Global Warming Solutions Act, Vermont is undertaking some bold steps to reduce our greenhouse gas emissions. But renewed support for wind and solar energy by our state government is critical to ensure the electricity we are using to heat and cool our homes and power our cars and trucks doesn't come from fossil fuels but clean, reliable and affordable renewable energy that is accessible to all Vermonters.

Peter Sterling is the interim Executive Director at Renewable Energy Vermont, the trade association representing Vermont's renewable energy industries. ♻

BIRTHPLACE OF ELECTRIC POWER – *Cont'd from p.14*

than one. 1837, the year he received his patents, also happened to be a year when a terrible economic depression started in America. The modern banking system had yet to be developed. As a result, he found it almost impossible to raise money. During the 1830s, he appears to have mortgaged everything he owned in Brandon. He was not a wealthy man to begin with. Instead of making him rich, his invention wound up impoverishing him.

The other problem was technological. Davenport invented his motor before anyone developed reliable electric power, or the ability to transmit it. His motors ran on expensive, somewhat unstable batteries. It was not until the 1840s that inventors in Britain began to solve the problem of generating power, using dynamos that were essentially Davenport motors in reverse. It would be decades before reliable electric power would become widely available. Unfortunately, by the mid-1840s, Davenport appears to have become bankrupt, exhausted and ill.

But Davenport never stopped believing in an electric future. In his unpublished memoir, he repeatedly makes that clear, arguing that electricity was a safer, quieter and cleaner source of energy than anything that came before. He envisioned a time in which electric power would benefit everyone. He would be thrilled and gratified by the myriad ways in which electric power has improved human existence. He'd be overjoyed to see an electric car.

He foresaw it all, but none of it would happen in his lifetime. In 1848, his father-in-law, a prosperous farmer, gave Davenport's wife, Emily, land in Salisbury, VT "for the consideration of my love and affection and… one dollar." Tellingly, Thomas's name does not appear on the deed. Davenport lived his last few years as a Vermont small farmer. He died on July 6, 1851, three days before his forty-ninth birthday. Despite his poverty and his many frustrations, he never gave up. Shortly before his death, he had been working on an electric piano.

On July 9 (Davenport's birthday) the Town of Brandon will be holding the first Davenport Electric Fest, celebrating both the achievements of Davenport and the incredibly promising future of electric vehicles. State Representatives Stephanie Jerome and Butch Shaw are sponsoring a resolution in the Vermont House in honor of the occasion.

In the meanwhile, David Hammond of the University of Vermont physics department, an expert in early scientific equipment, is building a working replica of Davenport's motor for the Brandon Museum, to be installed as the centerpiece of a forthcoming major exhibit on Davenport. The museum has also begun outreach to the schools. An Otter Valley High School course on "The Electric Motor and Its History" is running this semester, and the Neshobe School is also planning to teach this great Brandon story to local kids.

Together the town and museum want to honor Brandon's great inventor, make his name known as widely as it deserves and claim Brandon's place as "The Birthplace of Electric Power." In the process we just may position ourselves to have a role to play in the electric future that Davenport so clearly foresaw.

So here we are, 185 years after Thomas Davenports' first patent, in a world polluted by carbon and heading down the path of an uncertain future. We are finally realizing the value of Thomas Davenport's invention. Not only did he contribute to mobility, but he contributed towards a sustainable future. Now we live in a time where renewable energy is expanding, and younger generations are demanding we change our actions for a cleaner future, and we must re-ignite the passion that Thomas Davenport had towards electrifying the world.

Join us July 9th from 11-6pm at the Estabrook Park in Brandon VT to honor Thomas Davenport's contribution to sustainability and to experience the future of what an all-electric world would look and feel like.

Kevin Thornton is Brandon, Vermont's historian in residence. ♻

FEDERAL

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

REGIONAL

NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

MODEST GRANTS ARE AVAILABLE FOR COMMUNITY-BASED ENVIRONMENTAL WORK IN CT,MA,RI,NH,VT,ME

• Must be volunteer driven or have up to 2 full time paid staff or equiv.

• have an annual budget up to $100,000

• "Seed" grants of $250-$1,000 and "Grow" grants of $1,000-$3,500

• Go to www.grassrootsfund.org/grants/ or call 802-223-4622 for more info.

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.

• 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 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.

Pellet Sap Evaporators:
Incentives are available for new, high-efficiency wood pellet- or chip-fired evaporators utilized as primary evaporators completely replacing oil or cord wood-fired units. $200/sq-ft of evaporator pan. Info at RERC-vt.org

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 $1,000. Moderate income Vermonters get 50% off up to $3,000.

• 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: Get up-to-date information at: www.bit.ly/GET-NH-1

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: www.bit.ly/GET-NH-2 or at (603) 271-3670. Website: www.bit.ly/GET-NH-1

While we try to keep things up to date, incentives are always changing. Please be sure to check with the appropriate sources provided for the latest information.

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 levels 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 www.bit.ly/GET-NH-1.***

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

Residential Wood Pellet Boiler/Furnace

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

Contact: www.bit.ly/GET-NH-3
Website: www.bit.ly/GET-NH-1 for more information and current program status.

LOCAL INCENTIVES

Some towns provide property tax exemptions for renewables – visit www.bit.ly/NHtownRenewablesTaxBreaks

- *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.nh.gov/osi/energy. for more information.
- Plug-In Hybrid Electric Vehicles (PHEV), and $300 on Electric Motorcycles.

NH Home Performance with ENERGY STAR

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

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

NH ENERGY STAR Homes

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

NHSaves Residential ENERGY STAR ® certified Products Program

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

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

NHSAVES Online Store

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

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

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

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

NHSaves: 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.

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSERDA

Welcome to the New York solar incentive and rebate information: 169 programs and incentives at: http://dsireusa.org (enter your zipcode).

Programs and Services from NYSERDA: For the latest NYSERDA solar, ground source and air source heat pumps, EV residential and commercial incentives..

NYSERDA currently has a $1,500 per ton incentive on geothermal for residential systems.

Visit NYSERDA's new website. It is user-friendly and a one-stop learn-all site: https://www.nyserda.ny.gov/ny/PutEnergyToWork/Energy-Program-and-Incentives.

Extended Federal Tax Credits for Renewable Energy

Good news for renewable energy and climate action!

A budget package has finally been developed that begins to address the climate crisis.

Making local renewable energy more affordable, this bill translates directly into good jobs, less climate pollution and more resilient communities.
Among the most significant measures are extended tax credits for renewable energy.

SOLAR: The investment tax credit (ITC), which was scheduled to drop from 26% to 22% in 2021, will stay at 26% for two more years.

ADVANCE

D WOOD HEAT: For the first time, a 26% investment 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% tax credit was also extended for geothermal heat pump projects that begin construction in 2021 and 2022. Overall, the bill includes $600 million for wind energy, $1.35B for solar, and $1.35B for grid-scale energy storage. It also includes a plethora of stimulus measures for small businesses.

National Grid: Electric Vehicle Charging Station Make-Ready Program

- National Grid 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

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

MAINE

EFFICIENCY MAINE

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

Home Insulation: Efficiency Maine offers 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.

Heat and Cooling: Efficiency Maine offers rebates and financing for installing high-efficiency heating systems. To find out more, see bit.ly/EffME_HeatingSolutions. For business solutions see bit.ly/EffME_BusinessHeatingSolutions. Homeowners can estimate annual heating costs for different heating systems using the calculator at bit.ly/EffME_HeatCostComparison.

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, some multi-family buildings, and Maine's largest energy customers. Examples of eligible organizations include businesses, for-profit or non-profit; municipalities; education facilities; manufacturing and industrial facilities; other non-residential facilities; and residential buildings with five or more units. To learn more about Efficiency Maine's incentives for any of these, visit bit.ly/EffME_AtWork.

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.

ESG INVESTMENT ESSENTIALS

Want to invest in companies with a strong ESG strategy? Here's everything you need to know.

Sara Gutterman

Adobe stock/pixbox77

Due to a rising tide of sustainability-minded investors, the ESG (environmental, social, and governance) investing sector has achieved a 10x growth in the past two years. While institutional investors have led the charge, mission-driven, values-based millennials and Gen Z people interested in ESG factors have also played a major role in this exponential expansion.

Millennials and Gen Z are earning more, saving more, and investing earlier than previous generations. Not only do they comprise nearly 75% of the workforce, but they are also on the receiving end of tens of trillions of dollars of inheritance.

Socially Responsible Investing

These economic powerhouses are investing their capital on new platforms with new criteria. According to a recent COGNITION Smart Data survey:

- 99% of millennials are interested in sustainable investing, citing climate change as the main decision driver;
- Nearly 50% of millennials say that their top consideration when making purchasing decisions is ESG and corporate sustainability;
- Nearly 60% of millennials report that they have sold stock and stopped purchasing products from companies that are not serving the best interests of society or our planet.

By aligning their dollars with their values and using social media to spread the word, millennials are democratizing finance, accelerating the adoption of the issues that they care deeply about, and driving unprecedented levels of transparency and accountability, which will be with us for the long term.

Green Banks, Clean Stocks, and ESG Funds

When exploring sustainable finance and investing options, the first step is to analyze existing investments, the local community, banking relationships, savings accounts, and institutional relationships.

Green banks are emerging across the country, such as Climate First Bank and Aspiration, offering a spectrum of sustainable banking, lending, and finance options. Climate First Bank recently launched Regeneration Checking, a new consumer checking account developed in collaboration with Paul Hawken and his team at Project Regeneration.

The account offers a $100 donation to Project Regeneration for every new qualifying account, and 100% of the interest earned on the account is donated to Project Regeneration.

To ensure that investments and savings dollars are being allocated in sustainable ways, it's important to look up the holdings of mutual funds or exchange-rated funds (ETFs). Websites like Fossil Free Funds help investors align their dollars with their values by analyzing the fossil fuel exposure and carbon footprint of thousands of U.S. mutual funds and ETFs.

Many traditional 401(k) and IRA plans place money in mutual funds that are heavily invested in fossil fuels. Fortunately, there are now plenty of alternatives for sustainability-minded investors, like iShares Global Clean Energy ETF (a BlackRock offering) that focus on investments in renewable energy and Clean Tech companies

ESG Ratings and Financial Factors

A wide spectrum of mutual funds with ESG criteria now incorporate environmental, social, and governance metrics into the asset management and investment selection process. And, investors don't have to worry about giving up returns for mission alignment: These sustainability-focused funds often outperform their conventional counterparts.

Financial services companies like Newday Impact help investors develop triple-bottom-line portfolios that align E with financial returns.

Interactive Brokers, which operates the largest electronic trading platform in the United States, recently launched IMPACT, a mobile trading platform that allows conscious investors to develop investment plans based on their personal values by providing information about ESG practices, including accountability and transparency metrics.

The simple IMPACT app enables investors to prioritize 13 distinct values, such as clean air, pure water, ocean life, land health, ethical leadership, gender equality, racial equality, and sustainable product lifecycle. Investors can exclude investments based on categories like animal testing, fossil fuels, greenhouse emissions, hazardous waste, and high-water usage.

Some savvy sustainable investors rely on robo-advisors, or online financial advisors that utilize algorithms to develop portfolios based on risk tolerance, desired returns, and liquidity needs. Companies such as Betterment, Personal Capital, Acorns, M1 Finance, Ellevest, and Marcus Invest offer robo-advisory services for investors that want to put money into green companies without high investment minimums, management fees, commissions, or transaction costs.

Green Crypto Currency

Millennials and Gen Zs are also displaying a penchant for crypto currency. While options like Bitcoin, Ethereum, and Dogecoin are popular, their "mining" process is highly energy-intensive. Greener crypto options include companies like Cardano and Nano. All crypto investors should consider planting trees or purchasing carbon offsets to counterbalance the environmental impact of their investment activities.

Of course, investors can also keep their eyes open for private investment opportunities in emerging carbon tech companies, a mushrooming sector that has received nearly $90 billion in private investments over the past two years.

High growth areas within the carbon tech sector include electrification technologies, blockchain, carbon removal, clean hydrogen, smart grid technologies, advanced controls, vehicle-to-grid integration, high-performance materials that sequester carbon, food waste technology, and plant-based proteins.

Sara Gutterman is the cofounder and CEO of Green Builder Media.

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EnergyHub Acquires Packetized Energy. Will Grow in VT

George Harvey

Packetized Energy employees discuss results from recent software testing at the company's lab in Burlington, VT. The company's Mello device (foreground) transformed water heaters into smart devices that could balance the variability of renewable energy on the grid and enabled them to demonstrate the packetized algorithms with hundreds of devices. (UVM photo: Bailey Beltramo)

Packetized Energy, a company based in Burlington, Vermont, was sold in early March to a New York company, EnergyHub, which will continue the operation of the Burlington office.

Packetized Energy is a spinoff of the Electrical Engineering Department of the University of Vermont (UVM). UVM received $2 million as a grant from the U.S. Department of Energy, and then $3 million more in federal research funding, which led to the founding of the company. The company had nine employees at the time of acquisition, all of whom are now EnergyHub employees. Packetized's former CEO and now EnergyHub's vice president of Power Systems, Paul Hines, expects the Burlington office to double in size in the coming year.

To understand the importance of this, it is necessary to understand a bit about how the electric grid operates. Today, most of the grid operates on a baseload power paradigm that was developed in the days of steam locomotives, when the Model A Ford was a great new car. It depended on centralized power plants, transmission lines, and use of power that was only regulated by the size of the power lines to a given building. Many people are comfortable with the concept of baseload power, because that is what they have always had. They complain that renewables will never be sufficient for a power grid because, "the sun doesn't always shine and the wind doesn't always blow."

What they are missing is that baseload power generation is never sufficient to power a grid, because it has no ability to adjust to grid demand, and the demand is always changing. Because of that combination, baseload power is utterly incapable of powering the grid by itself and needs all sorts of load-following resources to do the job.

If that makes you think of renewables needing batteries, then good. It should.

Baseload power and the centralized grid it supports are not the only way to get electricity to users. In recent years, a decentralized power paradigm has been under development, powered by renewables. It has somewhat different requirements, and that is where Packetized Energy comes in.

I will simplify things. In the old days, when the demand for power changed, a grid operator would see the change on their dials. He would lift the phone receiver, and as soon as the operator said

Cont'd on p.19

Carbon Pricing Misconceptions

Katharine Gage

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The Intergovernmental Panel on Climate Change (IPCC) recently released the second part of its Sixth Assessment Report on climate change, focusing on impacts, mitigation, and adaptation, again drawing attention to the deteriorating future of the climate and the urgent need for action. It reports that many impacts are irreversible, but future damages to people, society, and ecosystems can be substantially reduced with near-term actions that keep global warming close to 1.5˚C.

The IPCC finds carbon pricing to be the "most powerful and efficient" emissions reduction policy, and a "critical tool in any cost-effective climate change mitigation strategy, as it provides a mechanism for linking climate action to economic development."

The United States remains one of only two developed countries that are not yet pricing carbon. The IPCC report also identifies rhetoric, misinformation, and polarization as key factors that have "delayed mitigation and adaptation action, most notably in the US." Let's explore some common myths that are delaying effective carbon pricing legislation.

Myth #1: Carbon pricing will increase our cost of living

What matters is the net effect. If we charge fossil fuel producers and importers a carbon fee, industries will pass these higher costs down to consumers. And as we know from current world events, increased fossil fuel prices raise our cost of living. Pairing carbon pricing with a cash-back dividend ensures that citizens are compensated (or even overcompensated) for these higher costs. When all of the money collected from the carbon fee is distributed to all households on an equal, per-capita basis, 85% of households will receive more in their dividend than they pay in trickle-down higher prices from the fee.

Breaking our reliance on fossil fuels and transitioning to clean energy solutions will prevent energy price spikes from production and inherent market problems, such as what we are seeing with Russia's invasion of Ukraine. As a bonus, taking the profits out of selling fossil fuels will also defund Russian aggression, because Russia relies heavily on its fossil fuel exports for war funding.

Myth #2: Carbon pricing will have regressive social impacts

An increase in fossil fuel prices has regressive social impacts because low-income households spend a higher proportion of their budget on those fuels. However, a carbon price with a full, equal household dividend has a progressive social impact, because it protects and helps low-income, middle-income, and marginalized communities. Low-income households naturally have smaller-than-average carbon footprints as a result of a lower-consumption lifestyle; so when everyone receives the same dividend, low-income households make money – to the point where 99% of the poorest fifth of the population will either break even or come out ahead. Minority communities will also disproportionately benefit, with about 90% of households breaking even or coming out ahead. A carbon price with a full, equal per capita dividend is an efficient step toward achieving environmental justice goals.

Myth #3: Carbon pricing will hurt the competitiveness of U.S. businesses in the global market

While it is true that implementing a national carbon price will temporarily increase U.S. production costs, carbon pricing policies can be designed to equalize these costs relative to our global competitors. Border carbon adjustments can be used to charge our carbon price on imports and rebate our carbon price to our exporters during trade with other countries that do not have a similar carbon price.

Since U.S. manufacturers are less carbon-intensive than those in many countries we trade with, pricing carbon actually gives U.S. exporters and manufacturers a competitive advantage. For example, a price on pollution will make cleaner U.S. steel cheaper than dirty steel from China.

Myth #4: Carbon pricing won't reduce carbon emissions fast enough

The IPCC calls for carbon pricing because it will make a big impact – for instance, the border-adjusted, cash-back carbon pricing bill in Congress is projected to reduce United States carbon emissions 47% by 2030 and 90% by 2050. This policy alone is nearly enough to put the United States on a path that aligns with the global emission reductions needed to hold 21st-century warming to 1.5˚C. Complementary policies can get us the rest of the way there.

When looking at the climate crisis from a global perspective, carbon pricing is the only national policy that allows us to hold other countries accountable for their emissions and incentivize them to harmonize their climate policies with ours. This is accomplished with border carbon adjustments, which World Trade Organization rules only allow to be used with an explicit price on carbon – not with other policies like regulations, subsidies, or incentives.

As the importance and likelihood of enacting strong climate policies increases, it is essential to consider the policies that will be best for the climate, the people, and the economy. We need options that reduce carbon emissions rapidly, protect Americans financially, ensure that our businesses can compete on a level playing field in the global market, and have an influence on emissions at a global scale. The best policy option for satisfying these objectives is border-adjusted, cash-back carbon pricing – please ask your congressmen to enact this important legislation.

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

References in this article will appear online when it is posted. ♻

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Energy Hub– *Cont'd from p.18*

"number please," he would ask to be connected to the operator of a load-following plant. If things went well, everything was back on kilter within a few minutes. In the meantime, output might have had to be adjusted so there was enough power, but not too much. Not enough would mean burned-out motors and other such problems. Too much meant transformers melted down, and the grid would fail hopelessly.

Using a new, distributed system, small generating plants, which could include solar and wind power, but could also include lots of other options, such as small hydropower, biomass, micro-turbines, pumped storage, batteries, and so on, down a long list. Also, instead of an almost unregulated demand system, some types of demand can be automatically deferred, and these include water heaters, electric vehicle charging, and certain other systems.

The problem with this is not that the sun doesn't always shine and the wind doesn't always blow. That really is no worse than the fact that the baseload power plant can't easily change output. The problem is that controlling the grid doesn't have some person noticing that demand changed using a phone to call the person at the load-following gas plant to tell him or her to change output. Instead, it requires a whole huge bunch of monitors calling a whole huge bunch of generators and users and doing that in a well-coordinated manner. And while that cannot be done using equipment made in 1922 by AT&T, it could easily be done by a set of relatively small computers. One hang-up, of course, is that the computer has to be programmed, and that is not easy, considering the complexity of the assignment.

Packetized Energy developed unique algorithms that run on devices, such as their smart water heater thermostat, which allows the aggregate demand from distributed loads to track, in real-time, the needs of the grid. They not only developed the algorithms but also demonstrated their effectiveness with real devices in real homes and showed load coordination at shorter time-scales than competing approaches.

And that is what Packetized Energy did to make itself worth buying. And that, indeed, is why this is a big deal. It may be the future of our electric power system.

The founders of Packetized Energy wrote a very readable paper about their technology that appeared in the *IEEE Spectrum*. It is "How to Prevent Blackouts by Packetizing the Power Grid," and it can be read online at www.bit.ly/Packetized. There is also a very well-done YouTube video on the Just Have a Think channel (youtu.be/NU3woCaFSZs). ♻

Many thanks to our sponsor:

Vermont Funding Opportunity

Vermont Interfaith Power & Light administers the Katy Gerke Memorial grant program for energy efficiency and renewable energy projects for Vermont faith communities.

Information at www.VTIPL.org describes how faith communities can apply for the matching grants intended to help these communities reduce the financial barriers in order to reduce their greenhouse gas emissions, while also meeting their obligations to their faith and to protecting the environment.

If you are considering a project with a faith community, please email info@VTIPL.org for more information on access to this grant program. ♻

A Solar-Powered DIY Irrigation System

John Pincince

For some years, my wife, Lucy, and I used a small gasoline generator to run a well pump for irrigation. This was not in keeping with our desire to reduce our consumption of fossil fuels. So, we looked into a photovoltaic (PV) system. Serendipitously, the Natural Resource Conservation Service was offering grants for alternative, low carbon footprint projects. We sized our system and included the amount of drip tape and accessories needed then applied and received a grant to cover a fair percentage of the cost.

Now our solar-powered Grundfos deep-well pump supplies all the irrigation water we need for our 26-foot by 48-foot hoop house and our over half acre of mixed annual vegetables, asparagus, fruit trees, strawberries, elderberry bushes and perennial flowers.

The pump is powered by four 250-watt solar panels connected to a general duty safety switch, a small **Grundfos digital control panel, a 100-psi pressure tank** then through underground conduit directly to the well head and down to the pump. We used two-flow reduction valves at the spigot because there was so much pressure it was blowing the end caps off the drip tape system we use. It is critical to have the correct pressure tank control switch so the tank does not go over the pressure that it is rated for.

We also have a lot of iron in the well water. The microscopic particles of iron were beginning to clog the drip tape, so we placed two in-line water filters to absorb some iron.

The PV panels are mounted on structures we built using mostly repurposed materials. Old 3/4-inch galvanized pipe from an apartment house, southern yellow pine and galvanized steel from a set of school bleachers and other odds and ends from different projects. We used the steel pieces to make two supports for each of the two support structures. We drilled three 3/4-inch holes in each support arm to allow for seasonal adjustment of the panels but found that there is plenty of energy produced without adjustments. For our latitude location in Maine, which is 44.28, we leave the panels at 45 degrees.

Solar irrigation system. *(Photos: John Pincince)*

The winds blow quite strongly in this exposed location so to secure the two mounting structures holding the four panels we used 3/16-inch galvanized cables fastened to 18 inch long cork screw type ground anchors. They have been in place for three years now without too much of a problem. The supports did move off the concrete blocks they were set on. I decided to let them sit on the ground. I'll use cardboard as a weed barrier under the panels and use some crushed rock under the legs of the support structures to allow for drainage. This winter a very high northwest wind caused a set of two panels to flip forward onto the ground because, on one side, the stainless-steel bolt and nut that kept the adjustable arm in place had come undone. Wind vibration then caused the other arm to slip off. Thankfully no damage was done because the panels are joined together across the underside and then are attached to the frame of the structure with heavy galvanized strap hinges which we used because we thought we would need to adjust the angle during the growing season.

No wires pulled out because there was enough slack - good planning and good luck.

There are more permanent types of structures used to mount panels, but we like the idea of using what is at hand and avoid using any pressure treated wood, as this is a certified organic farm.

To irrigate, we run four garden hoses from a multi-faucet attachment to the header pipes for each major crop type. One supplies all the **drip tapes** for the annual vegetables in the **hoop house**. One connects to the **field vegetables and asparagus, one to the fruit trees, and one to the strawberries.** This way we can control each at the faucet. We also have shutoffs in some of the drip tapes so we can stop irrigating crop rows that may need less water than others. Keep in mind that until the plants are well established the drip tape needs to be secured with ground staples. You can make your own with 12-gauge galvanized wire or purchase them from FEDCO in Maine.

The drip tape system is very efficient. The water goes directly onto and into the ground near the seeds, seedlings and maturing plants. Very little is lost to evaporation and aside from the spring laying out and autumn retrieval and storage, very little of my time is needed to irrigate. The downside is that the drip tape is plastic. We have used the same drip for tape five years or more. Still, it is plastic and we wish we could use it for ten years at least.

The beauty of it all is that when the sun is out, the system is working, except when there is enough water in the ground, then we turn it off. When it is raining, we obviously don't need it and even if the system is still switched on, it is not getting any sun so it is not pumping.

To install the solar system, we had expert help from a friend who is an electrician and between my wife and I we had enough basic plumbing skills to plumb the system. We set the well pump into the well and hooked up the pressure tank, but we did need advice regarding the pressure switch. It needs to be matched to the **pressure tank** and able to work with direct current. The tank is rated to 100 psi. Ours is a 60/40 switch. When the pressure reaches 60, the switch shuts off. When the pressure goes below 40, the switch turns on.

We always disconnect the well pipe at the well head and at the pressure tank before the heavy freezes signal the approach of winter. To store the 25 fifty-foot lengths of drip tape for winter, we keep each strip at full length, bunch them together and stretch them on the ground on the north side of the hoop house with some weight on them. They are out of the sun and won't blow away. Although despite our best efforts, well maybe they could be better, the wind sometimes causes the tapes to cross over one another, but we're able to deal with that pretty easily. Doing it alone however is not recommended!

It is possible to use these panels along with storage batteries to provide lighting to extend our cool season crops in the hoop-house. We would also supply a little heat with fresh horse manure. Water-filled black painted barrels could help moderate temperature in the hoop-house, too. Maybe someday!

Control panel.

Electric Hook up

Pressure tank

John Pincince lives with his wife and cat in West Penobscot Bay in Lincolnville, ME. They grow their own food and have an Air-BnB apartment on their beautiful land. John is active in ways to protect the nature of Maine by collecting signatures and writing letters regarding the proposed CMP corridor and to prevent a massive pier from desecrating the shoreline that is so dear to all the generations that have walked, kayaked, canoed or sailed along it. ♻

Lawn Transformation: Out with the Old, In with the New

Alicia Brisson, Krista Fillion, and Lyndsey Parrott

On Dec. 1, the Vermont Climate Council released and adopted the state's first Climate Action Plan. This provides strategies to reduce emissions within Vermont to meet the goals of the 2020 Global Warming Solutions Act, which includes reducing greenhouse gas pollution to 26% below 2005 levels by 2025.

To meet these objectives, significant lifestyle changes are needed. In particular, this includes the way we acknowledge green spaces within Vermont as individuals working towards a collective future.

Transforming turfgrass lawns — the biggest irrigated crop in America — into sustainable alternatives may be one of the most cost-effective approaches to achieving these goals within the state of Vermont.

Historically, front lawns were a luxury of the wealthy, which indicated an investment of time and equipment. After World War II, the middle class emulated the keeping of lawns from the affluent as a symbol of status. Lawns are perceived as a material manifestation of the American Dream and the pinnacle of suburban development.

In many communities today, there is peer pressure to keep a well-manicured lawn to reflect socially desirable resources such as wealth, education and property values. Given this context of lawns as an institution for status, it is time to create new traditions with how we use our green spaces to reflect the values of today.

Many residents misuse the amount of water that is necessary for proper turfgrass care. Lawns do not require water every day, as many believe. Most turfgrass is overwatered daily, which causes excessive mowing, wastes water, and increases stormwater runoff. A recommendation given by a University of Vermont professor states to not exceed 1 to 1.5 inches of water each week, including rainfall. Irrigation of lawns creates a strenuous impact on lakes such as Lake Champlain, due to excessive runoff that includes phosphorus and carbon emissions.

Improper application of fertilizer containing phosphorus during winter months can lead to nutrient runoff into the lake. The Lawn to Lake Initiative of the Lake Champlain Basin Program determined that 1 acre of urban-suburban land contributes twice as much phosphorus to the lake as 1 acre of farmland.

Furthermore, the 2021 State of the Lake calculated that each year, indicates the lake's tributaries deliver close to 2 million pounds of phosphorus. Lake Champlain, with its proximity to Burlington, is at the receiving end of phosphorus runoff, which can lead to eutrophication, cyanobacteria, reduced clarity, and loss of species.

The perception of a well-manicured lawn, free from weeds and pests, has detrimental effects on the future of natural spaces such as Lake Champlain.

This pursuit of aesthetics is evident in the 5.5 million gallons of gasoline that Vermonters burned in 2019 on lawn care. Tedious maintenance practices — including irrigation, mowing, fertilizer and pesticide application — have been found to add up to 1 ton of CO_2 each year per acre of traditional lawns. Shockingly, it takes only a half-hour of yard work with a two-stroke leaf blower to generate the same amount of emissions as a 3,900-mile drive from Texas to Alaska in a Ford Raptor. It takes hours of time invested weekly to upkeep a pristine monoculture of turfgrass at the expense of the climate, all for the sake of upholding outdated norms.

Within Vermont, greenhouse gas emissions peaked in 2005 at 9.98 million metric tons of CO_2 equivalent. This level had decreased to 8.64 million metric tons as of 2018, but a continued reduction is needed to be on track for Vermont's goals.

Although Vermont has already made strides toward reducing emissions, the size of the state provides an untapped opportunity for improvements. In Vermont, the median yard space is 73,979 square feet, which is the largest yard space within the United States, well above the average of 10,871 square feet. Due to the amount of lawn area in Vermont, curtailing maintenance practices will make a drastic difference.

As stated by the Vermont Climate Council, "It is critical that we act to become more resilient and adaptive to climate change already underway and that we do more to reduce the emissions that have brought us to this point, in order to create a habitable future."

To meet the target emission goals of the Global Warming Solutions Act and protect the future of Lake Champlain, lawn conversion initiatives can be a cost-effective approach to reduce the overarching threats of climate change without making a large personal sacrifice.

Having a unique polyculture such as a lawn comes with a variety of benefits, both aesthetic and practical. The area around our homes is a place that could be used for pollinator habitats, food production, increased biodiversity and native species. This shift in mentality will deter the excessive use of water, phosphorus runoff, and carbon emissions that are associated with the maintenance of a turfgrass monoculture lawn. Growing herbs and vegetables can serve as supplemental food security — or even income, with some entrepreneurial spirit.

This article has numerous reference links. They will be available in the online post of the article.

The authors are students at the University of Vermont. Alicia Brisson, class of 2022, is studying environmental studies, Krista Fillion, class of 2023, is studying community development and food systems, and Lyndsey Parrott, class of 2022, is studying community and international development. ♻

DIY Raised Bed Gardening – Cont'd from p.1

will leach into the soil around them and will be absorbed by plantings in that soil, i.e., your vegetables!

The wood you are looking for will be naturally rot- and bug- resistant. What does this mean? The resins in certain species help the trees defend themselves against the effects of nature, namely decay and pests. The lumber from these species will retain these desirable qualities.

You don't need to have planed lumber – buying it in the rough will be more cost-effective, and the dimensions will be "true" (i.e., your two by six will actually measure two inches by six inches.) Just make sure you wear gloves if you want to avoid splinters.

Green or unseasoned lumber is fine for raised beds. Kiln-dried lumber has had most of the moisture extracted from it in order to keep it from shrinking and cracking in interior applications. Your lumber will be exposed to water, which has a 100% moisture content, and the summer air (think of the relative humidity number in the weather forecast). Kiln drying is one fewer process to pay for.

Three Great Lumber Species to Use

1. Native eastern hemlock

In New Hampshire, one of our most prolific indigenous species is eastern hemlock. We have found that, at a fraction of the cost of cedar or fir, it will last in the ground up to seven years. It is definitely the local favorite wood choice for raised bed gardening.

Eastern hemlock is also local and ecologically responsible in the following ways.

- The logs are harvested and sawn here in New Hampshire
- The sale of hemlock supports the local economy at every level of production
- It avoids the cost and pollution of long-distance transport
- When it decays or is discarded, an indigenous species is put back into the earth

Blogspot.com

2. Douglas fir

Douglas fir, or Doug fir, is another great wood to use. It is readily available locally, and although it is largely grown in the western states, the trees are often planted in New Hampshire.

There are several grades of Doug fir available. The most cost-effective is essentially a mill-run grade that allows for sound tight knots. This means that the knots will not fall out and create holes in your piece of lumber. Even this grade will cost approximately four times the cost of the eastern hemlock.

3. Western red cedar

Also grown in the western regions of the United States, western red cedar is readily available. If you are locating your raised beds more as planter boxes on your deck, you may want to consider using a knot-free grade, usually denoted by "A+" or "CVG" (clear vertical grain).

If you still like the idea of the red cedar, but not the price tag on the higher grade, take a look at the mill run or knotty grade. It's still pricey, at a little more than six times the cost of the Eastern Hemlock but is a fraction of the cost of the clear grade.

Size of Your Raised Bed

A common width for raised beds is four feet. This makes the entire bed within your reach. But you need to be mindful of the length of your raised beds. The longer the bed, the greater the outward pressure from the soil. The maximum length of each bed should be six to eight feet. If you want it longer, you should add interior partitions. Construct the interior partition the same way you created your end wall.

Fasteners

When assembling your raised bed, screw-type fasteners are the way to go. They should be at least 3 ½ inches to four inches long and have these features:

- Big heads or washers under the heads to resist the outward pressure of the soil.
- Deep threads for better holding power. Self-cutting threads are the best.
- Galvanizing or special coating for longevity.

Lumber supply stores have many types of fasteners. Ask for coated structural screws

Happy gardening!

Lydia West is the Chief Financial Officer at Goosebay Sawmill and Lumber located in Chichester, NH. Learn more at www.goosebaylumber.net. ♻

Storytelling Helps Overcome Barriers to Adopting Climate Solutions

Colleen Ward

I grew up in beautiful Colorado and experienced multiple impacts of climate change firsthand. They have shaped my passion to communicate and drive climate actions that we can all take.

I was at my childhood home when our house flooded overnight. Unaware of the extent of the widespread flooding in the morning, I started driving down a hill until I saw the road and entire valley was submerged under a large body of flowing water – only a few feet away from me. I have also experienced wildfires and tornadoes. As I write this from where I now live in Vermont, a fire is burning near my old high school and destroying forests I grew up in. These events have destroyed my family and friends' longtime homes and neighborhoods and continue to threaten their safety and health.

Amelia Nuding shares with Colleen how the public can get involved in clean energy adoption and water conservation in her video interview for Bloomcradle.com. (Photos: Colleen Ward)

Seeing your community in flames, underwater, or facing any climate catastrophe stops you in your tracks. You ask yourself, "What can I do? "What can we all do?"

People in the U.S. hold immense power to mitigate carbon emissions, shape energy policy decisions, and address the climate emergency. We all have the opportunity to protect the people and places we love.

Nearly 70% of people in the United States "feel a personal sense of responsibility to help reduce global warming" according to the 2021 study, "Climate Change in the American Mind" by the Yale Center for Climate Communication and George Mason University Center for Climate Communication.

While everyone plays a crucial role, most people do not know that we, as individuals, can be part of climate solutions that make an impact. Most individuals don't know what specific actions they can take to reduce carbon emissions, which actions provide the highest carbon reductions, or how to adopt clean technologies. Right now, in Vermont, more residents need to be empowered to take actions that mitigate carbon emissions immediately to address the climate emergency and meet Vermont's state climate goals. According to the Yale Center for Climate Communications, 65% of Vermont residents are worried about global warming. These alarmed and concerned groups are the prime individuals to be a part of climate solutions. However, these individuals may not be engaged in the most proven, effective solutions and strategies from the clean tech industry.

Solution-oriented, human-centered storytelling is the most effective method for driving behavior change, as supported by studies from the Yale School for Climate Communication, Columbia University, George Mason University, EcoAmerica, and others. These studies demonstrate that first-hand personal stories have the power to build empathy, shape mindsets, and change behaviors to participate in climate solutions.

These leading voices are studying the psychology that motivates climate action and have found that local, personal stories are a key strategy to drive behavior change. Columbia University's Center for Research on Environmental Decisions Guide specifically suggests the following principles: know your audience, tap into social identities and affiliations, make behavior change easier, encourage group participation, and utilize concrete experience.

It's critical to rapidly engage and increase the number of people to go from the consideration to adoption phase of clean technologies. Testimonials are a form of storytelling that allows those interested to learn and connect to the person, and human stories of adopters of the technology. The adopter stories help answer questions, ease concerns, explain the full range of benefits, and provide those interested the confidence to adopt the technology knowing someone else went through it. There is plenty of evidence within clean energy industries that these principles work:

- Data shows that there was a 44% increase in solar installations nationwide within a half-mile radius after one rooftop system was added.
- Testimonials are the most effective tool for adoption of rooftop solar along with other clean technologies.
- One-third of customers out of 230,000 SolarCity rooftop solar installations nationwide were referred by a friend or a neighbor.
- "How to Get Involved" is the most viewed type of video across our Bloomcradle.com website videos, which hosts stories of individuals taking climate action.

Coupling testimonials with video (i.e., how the majority of Americans get their information) is a proven effective tool. Videos are a proven tool that drives climate behavior change and clean tech adoption from Yale Climate Communication studies, across U.S. utilities, and clean technology industries. People are looking for solutions and it's time to engage every person with effective storytelling so they can be part of solutions.

These are the principles I have deployed with the non-profit I founded at Bloomcradle.com that reinforce these findings: capturing relatable stories on video of everyday people and other leaders taking actions generates increased action by their family, friends, neighbors and communities. In effect, we can all be climate heroes.

Colleen Ward is the founder and Executive Director of Bloomcradle, a Vermont-based climate action non-profit at Bloomcradle.com. Colleen has fifteen years of experience developing clean energy products and leading clean energy customer adoption programs and communications working at utilities, the United Nations, and with non-profits. She holds a Master of Science degree in Sustainability Management from Columbia University and a Bachelor of Arts in Diplomacy and World Affairs from Occidental College. ♻

Eric Bishop von Wettberg of South Burlington, VT shares his success with new rooftop solar installation during his video interview for Bloomcradle.com.

Talking Trash

John Bos

TRASH. *Noun:* "discarded matter; refuse." Synonyms: waste · waste material · refuse · litter · garbage · debris · junk · dross · detritus · sweepings · dregs · remains · rubbish.

The biggest environmental cover-up operation in America has to do with where we send or dump our trash on land and at sea.

Throughout the country, subterranean garbage heaps (aka landfills) are rising, fueled by the 292.4 million tons of municipal solid waste (MSW) the U.S. produces each year. According to the EPA, in 2018, half of that trash went to landfills around the country. Worse, yearly MSW production has been steadily climbing, year after year since monitoring first began in the 1960s. The U.S. has never had a national recycling rate (recovered material plus composting) higher than 35% of all its waste.

That includes 22 billion plastic bottles every year. Enough office paper to construct a 12-foot-high wall from Los Angeles to Manhattan. It is 300 laps around the equator in paper and plastic cups, forks, and spoons. It is 500 disposable cups per average American worker – cups that will still be sitting in the landfill five centuries from now.

Birds fly over the piles of garbage at the Fresh Kills Landfill in 1993. (Image courtesy of the Staten Island Institute Archives)

The average American tosses 4.4 pounds of trash every single day. It may not seem all that astonishing on the surface, but with 332 million people living in the U.S. that is roughly 730,400 tons of garbage each day, enough to fill more than 63,000 garbage trucks.

When I lived in New York City's SoHo district in the 70s, my young son and I would take the ferry from lower Manhattan over to Staten Island to bike around the island. That was preferable to biking on the decommissioned parts of the old West Side Highway. On one trip, we encountered an entrance to the Fresh Kills Landfill (known as the Staten Island Landfill). The landfill covered 2,200 acres located along the banks of the Fresh Kills estuary on the western side of the island. Dozens of garbage trucks and front loaders crawled over this mountain of trash with thousands of seagulls above them like predators searching for scraps of food.

"Out of sight, out of mind" seems to be the order of the day for most Americans. But major ecological impacts are beginning to be noticed. From hazardous waste to running out of space, we are on our way to being overwhelmed by the growing scarcity and rising cost of landfills in small communities and large cities.

Then there is ocean trash, one of the world's biggest pollution problems. The numbers are staggering: There are 5.25 trillion pieces of plastic debris in the ocean. Of that mass, 269,000 tons float on the surface, while some four billion plastic microfibers per square kilometer litter the deep sea. But that's not all.

One can only wonder what the environmental impacts are on the oceans that swallow shipping containers that tumble from ships in heavy seas. According to the World Shipping Council, this amounted to an annual average of 779 over board containers between 2017 and 2019.

This is not the only source of ocean pollution. New York City once used to transport and dump its municipal sludge (treated material from the city's 14 water treatment plants) into the Atlantic Ocean. This was stopped in June 1992, marking the cessation of this method of waste management by all cities in America.

I have only touched the surface (no pun intended) of everything that is being dumped into our oceans. The unmentioned "trash" includes everything from downed

Cont'd on p.23

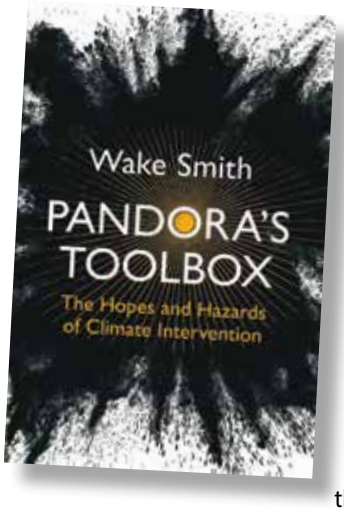
Book Review:

PANDORA'S TOOLBOX

The Hopes and Hazards of Climate Intervention

By Wake Smith, Cambridge University Press, Cambridge, UK 2022, 343 pages plus appendices, notes and index.

Book Review by Janis Petzel, MD



There is a lot to chew on in Pandora's Toolbox, the disturbing new book by author and former division president at Boeing, Wake Smith. Smith is a lecturer at Yale University and a Fellow at the Harvard Business School. He is a strong advocate for a type of solar radiation management called Stratospheric Aerosol Injection (SAI). SAI is a geoengineering approach that proposes to inject reflective materials like sulfur dioxide or diamond dust high into Earth's atmosphere to reflect some of the sun's heat back into space. Once the aerosols are released, they rapid spread through the atmosphere and are carried north or south to the poles.

If you remember the myth of Pandora's Box—when the box was opened against the advice of the gods by a woman whose curiosity got the best of her, evil spirts, illnesses, and hardships were released into the world. From a psychoanalytic point of view, Pandora's Toolbox is an interesting choice of metaphor from a proponent of geoengineering. Maybe deep down, Smith worries SAI could be trouble?

The SAI technique does nothing to correct the underlying pathology of climate change, which is high levels of carbon dioxide in Earth's atmosphere from the burning of fossil fuels and the release of greenhouse gases like methane and certain refrigerants. Another huge environmental problem results from burning fossil fuels as the ocean acidifies from dissolved carbon dioxide. But Smith sees SAI as one of the few viable options available to prevent untenable global temperature increases.

There has been much resistance and public outcry against even small live tests of SAI, so the research on SAI is currently done via computer modeling. Opponents worry about unintended consequences, like damaging the protective ozone layer in the stratosphere and reducing rainfall in parts of the world leading to crop failures. The sky would likely look white, and solar panels would be less effective. Pandora's Toolbox agrees these are areas that need more research, along with figuring out how to build a world-wide consensus.

The first 148 pages of this book are a review of current climate science, international climate agreements and mitigation options, such as carbon capture and sequestration (CCS), and why Smith thinks they are inadequate to meet the need. The subsequent sections on solar radiation management covered topics you might not see elsewhere—cloud brightening for one.

Smith's true interests show up in Chapter 15, SAI Deployment. He wants to build planes flown by live pilots. Planes can easily reach the stratosphere. Here, and in the book's summary, Smith devotes 13 pages to designs for aircraft and gadgets to deliver the SAI aerosols 11 miles up into the stratosphere (from zero to seven miles up is troposphere; 7 to 30 miles up is stratosphere).

Given the troubling history of corporate malfeasance, lying and greenwashing with Big Tobacco, Big Oil, Big Pharma, etc., a book by a corporate aerospace executive formerly of Boeing (remember the 737 Max crashes?) pushing ahead at this level of detail before there is consensus on the need for SAI, is not likely to engender trust in the wider community. But he is committed. Smith states "there is no end in sight as regards the narrow row that I intend to hoe in trying to illuminate the practicalities to SAI implementation."

The biggest issues I have with this book are the ethics and the economics. He relies heavily on the economic concept of "discounting" (a dollar today is worth more than a dollar in the future). Based on his economic perspective, he asserts that a "rational actor" might prefer warming of 2ºC over 1.5ºC, or 3ºC over 2ºC." He did not define "rational." Climate goals from the Paris Accords in 2015, and in other accords aim to limit global warming to below 2ºC and preferably to 1.5ºC compared to pre-industrial levels.

Smith relies on 2013 work by Nobel Laureate and climate economist William Nordhaus. Smith quotes Nordhaus, "The economic impacts from climate change will be small relative to the likely overall changes in economic activity over the next half century to century," so the projected increase in per capita GDP for poor and middle-income countries would offset the changes in standard of living from a 3ºC warming.

Smith writes "When we ask ourselves how much economic sacrifice we should undertake on behalf of unborn generations, it is important to recognize how much richer those future citizens are likely to be and therefore how much more affordable climate defenses will be for them than they are for us." What in the world is he thinking?

Interestingly, Nordhaus's work in 2021 is supportive of mitigation. He calculates the externalized costs of pollution (companies externalize their expenses by dumping their wastes into the air and water for someone else to clean up) and the benefits of reducing pollution. He does this with a price on carbon, something the Citizens' Climate Lobby has advocated for years. (if you have a chance, check out EN-ROADS, an interactive program on carbon emissions. Carbon pricing and taxes have the best impact, and dividends are likely to be popular, as they are in Alaska as Smith points out).

When carbon is priced, the resulting economic growth is obvious. Mitigation pays for itself and then some. Nordhaus recently wrote "Those who claim that environmental regulations harm economic growth are completely wrong, because they are using the wrong yardstick."

The point of my focus on Nordhaus is that Smith uses his work to explain why many mitigation strategies are not cost effective against business as usual. For example, in discussing the removal of carbon dioxide from the atmosphere, Smith states we would need 1000 more units like the CCS plant in Iceland to make a dent in the excess carbon in the atmosphere. Smith is not encouraging about the finances. He is a hammer and SAI is his nail.

He also pushes SAI because he thinks it may potentially take centuries for climate to stabilize once we stop emissions or get to net zero. Humankind is very fortunate that this assumption may be inaccurate.

In a great review of newer climate models called Earth System Models, which take dynamic carbon cycles into account, Zeke Hauser shows that, "If emissions are cut to zero...atmospheric concentrations of CO2 would quickly fall [over 20 years], before eventually stabilizing at a lower level."

Smith is correct that there is a mind warp preventing all of us and our governments from acting on the data we have. Why are we letting our world get to crisis tipping points when we have the technology, money, and knowledge to do something more sensible? Some of it is who controls the money and resources (looking at you, Putin, corporate shills, political hacks, and oligarchs everywhere). Some of it may be that the human response to too many choices is to make none.

What if Smith is right and SAI is the last-ditch chemotherapy to save life as we know it? Would that motivate us to get petroleum products out of our lives now? Are we up to fighting the dark side of dirty oil money? Maybe instead of increasing the world supply of oil and gas in response to the violent Russian invasion of Ukraine, we could choose to rapidly decrease demand for fossil fuels by a heroic focus on clean energy.

I'll close with an analogy: My parents were heavy smokers. Each attempted to quit numerous times without success, until each of them developed terminal illnesses. Once they realized they were going to die, they quit smoking, when it had no chance of saving them. It was tragic.

Let's not be tragic in the same way when it comes to fossil fuels. The idea that reputable scientists are even considering the need for SAI ought to scare the bejesus out of us, like stage 4 non-small cell adenocarcinoma terrified my mother.

For me, buying oil and gas has become intolerable from a moral perspective. We have good options for alternatives. Please do what you can to stop the emissions from your own lifestyle. Demand our government holds polluters responsible. Push for a carbon tax, with dividends for those most impacted. Push to stop the subsidizing of fossil fuels. It's not kum-ba-yah. It's good economics. Let's keep the lid on Pandora's Toolbox.

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.

Wake Smith

Wake Smith is a lecturer at Yale University. He teaches a world-leading undergraduate course on climate intervention, the syllabus of which forms the basis of this book. Smith is also a Senior Fellow at the Mossavar-Rahmani Center for Business and Government at Harvard Kennedy School, writing scholarly articles on the aeronautics, costs, and governance of solar geoengineering. Smith served in several executive roles in the commercial aviation industry, including as the President of the flight training division of Boeing and the COO of Atlas Air. He is a graduate of Yale College and Harvard Business School. ♻

<< Cont'd from p.22

military aircraft and ships from many wars to the dropping of 2,580 out-of-service subway cars by the NYC Metropolitan Transit Authority (MTA) into the Atlantic Ocean from 2001 to 2010 off the coasts of New Jersey, Delaware, Maryland, Virginia, South Carolina, and Georgia to create artificial reefs.

A 1970 "Report to the President from the Council on Environmental Quality" on ocean dumping reported that in 1968 the following was dumped in the ocean in the U.S.: 38 million tons of dredged material (34 percent of which was polluted), 4.5 million tons of industrial wastes, 4.5 million tons of sewage sludge (significantly contaminated with heavy metals), and 0.5 million tons of construction and demolition debris.

Coming ashore, I don't have the space to describe the similar impacts of the 3,091 active landfills in 2020 in the U.S. and the over 10,000 old municipal landfills monitored by the Environmental Protection Agency.

My research for this article took me to Hope Jahren's book *The Story of More: How We Got to Climate Change and Where to Go from Here*. She investigates the connection between our climate crisis and our global population's insatiable desire to consume. Published in 2020, *The Story of More* is part scientific study and part memoir. In it, Jahren examines the 50-year timeline between her birth in 1969 and the present day. Jahren argues that our current population consumes far more resources than our ancestors ever did and that these skyrocketing rates of consumption have led to global environmental destruction and climatological change.

Of interest to readers of *Green Energy Times* may be Jahren's Chapter 10 in which she discusses the amount of energy that first world countries consume. She notes that we are so used to the presence of electricity that we take it for granted, forgetting that on a minute-by-minute basis we rely on electricity to assist with almost every task.

And finally, does anyone believe enough Americans would dial back the comfortable, convenient, consumer intensive lifestyles fueled by our dependence upon fossil fuels to reverse our catastrophic climate crisis?

John Bos is a contributing writer for Green Energy Times. *His bi-weekly column "Connecting the Dots" is published every other Saturday in the* Greenfield Recorder. *He is the editor of a new children's book* After the Race. *Questions and comments are invited at john01370@gmail.com.* ♻

Climate Breakdown is Accelerating Rapidly

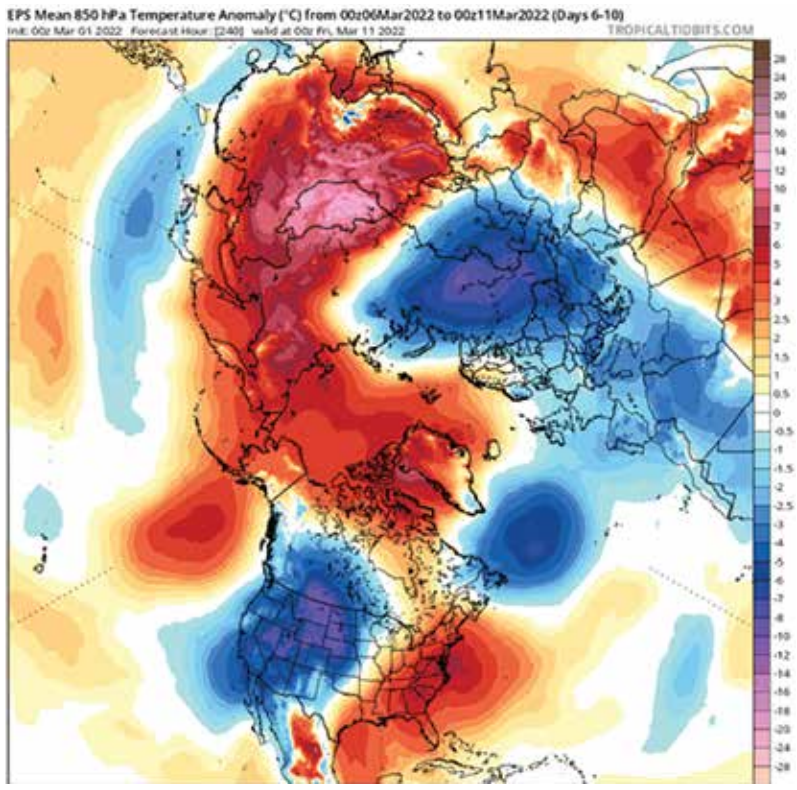
Dr. Alan K. Betts

A new IPCC report on February 28 on the climate crisis is very bleak. It recognizes climate breakdown is accelerating rapidly. Many of the impacts will be more severe than predicted and there is only a narrow chance left of avoiding its worst ravages. Even at current levels, human actions in heating the climate are causing dangerous and widespread disruption, threatening devastation to swathes of the natural world and rendering many areas unlivable. Key ecosystems are losing their ability to absorb carbon dioxide, turning them from carbon sinks to carbon sources. The report is a damning indictment of failed climate leadership. We talk about carbon neutrality by 2050 when we need to halve our emissions by 2030. We do not intend to do this because business-as-usual and the fossil fuel empire plan to make trillions from destroying the Earth. So, we continue to head towards high emissions trajectories.

So that readers can prepare, let us discuss some broader aspects of the climate crisis. The latest crop modelling studies from NASA using a range of climate model simulations (called CMIP-6) to drive 12 state-of-the-art global crop models show a large impact as early as 2030 under high greenhouse gas emissions. Maize crop yields are projected to decline 24% as warmer tropical temperatures stress plants. Yields of wheat however may initially increase as northern mid-latitudes get warmer. The localization and diversification of our crops are key strategies, but this is another reminder that the growing global population is not sustainable. It is early March and I just watered my spinach and lettuce that are doing well under sheets of glass. Start growing your own food.

The global rise in wildfires that we have seen last year in the U.S. and Canada, Siberia and Australia is going to continue and wreak havoc on the environment, wildlife, human health and infrastructure. In the U.S., nearly 7.7m acres (3m hectares) burned last year, and these blazes are getting increasingly hard to fight. We spend a lot of money fighting fires, but very little on planning, preparation and recovery. This is a familiar pattern as our society spends rather little on reducing climate change, since it tacitly accepts the strategy of the Fossil Empire and many business sectors to maximize their profits by burning all the fossil fuels.

The current 22-year megadrought in the southwestern U.S. continues, and water supplies are becoming critical. It has overtaken a major drought in the 1500s, and based on tree rings that go back to 800 AD it is now the most severe in 1200 years. 2021 continued a pattern of reduced rainfall in the west and increased rainfall and many storms in the east, coming from the Atlantic or the Gulf.



Here are the warm and cold temperature anomalies for the 850 hPa temperature forecast by the ECMWF model on March 1 for March 6-11. Notice the large shifts of ±6ºC (±11ºF) across the U.S., between cold in the west and warm in the east.

We are not grasping the entire picture of the economic damage to society. NOAA estimated climate disasters in the U.S. in 2021 that cost $1 billion or more, totaled $145 billion and killed 688 people. However, the increasing severity of storms and more frequent severe tornadoes, even into December, damaged over half a million homes with an estimated cost of $124 billion. After striking the Gulf coast, Hurricane Ida merged with a frontal system, intensified and damaged 1.2 million homes in the north-east with estimated record reconstruction costs of $395 billion. Yet society still refuses to bill the Fossil Empire for these damages, even though the oil industry knew forty years ago that it would be responsible and has lied about this ever since. This is absurd: they should be forced to pay for the damages now.

Our weather this winter in the North-east has shown rapid shifts in weather extremes that are referred to as weather whiplash, with changes in temperature of ±50ºF in 24-48 hours. Recently, the daily high temperature of 55ºF was at 3 a.m. with heavy rain, and temperature fell all afternoon reaching a low of 15ºF the following midnight. It is hard to grasp maximum temperatures after midnight, driven by strong southerly advection all the way from the Gulf; followed by north winds from Canada. In the big picture the polar vortex has split in two.

A critical issue for the *G.E.T.* community is the scale of the workforce to make the needed transformation of society in the coming decade. The workforce needed to rebuild will not appear overnight, even if Congress really passes bills to fund dealing with climate change. You all know the opposition that exists to change and the webs of lies denying that climate change is real. The struggle between the truth that sets you free to act on behalf of the living Earth, and all these lying forces determined to profit from the destruction of the Earth has to be confronted. I suggest we advertise with enthusiasm all our triumphs. Change is hard for old people (and especially old politicians). Every time I see my car salesman at the dealership, I joke that my plug-in Prius is averaging only 160 mpg on the first 50,000 miles; and that its highway range is still over 600 miles. He will mutter, "How much do you spend on electricity?" I say perhaps a few dollars a week, but my solar panels pay for that. I am wearing him down, as now he says, "When I buy my next car, I will check out a plug-in, but not now!"

This is the last decade to soften the impact of climate change. We have to choose between backing the living Earth or the criminal, lying fossil fuel empire. The choice is obvious to the sane, but not to those trapped in webs of lies and the misuse of human power. Take a breath and remember our children and all of life on Earth.

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

Delay Is Death – *Cont'd from p.1*

regions within decades.

"There are more extremes than the IPCC predicted just a few years ago," said Rebecca Carter, acting director for climate resilience practice with the World Resources Institute, a Washington, D.C.-based environmental and policy think tank. "This is not just about the future any more. This is now. We didn't prevent climate change." Carter was not involved with producing the report.

The body of scientific research on global warming's health impacts, including on mental health, has grown since the IPCC's last climate assessment cycle in 2014. It shows that scientists until recently have underestimated the threat of the rapid spread of new infectious diseases, like tropical pathogens carried by insects that are expanding their ranges to areas formerly too cold for them, for example. And the looming climate threat is raising concerns about serious psychological trauma for many experiencing existential fear, especially young people.

"Delay is death," said United Nations Secretary General António Guterres,

AdobeStock_268547905/Nicola

summarizing the findings of the latest in a 30-year series of reports that are the scientific foundation of the Paris agreement to limit global warming close to 1.5 degrees Celsius (3.6 degrees Fahrenheit), which was reached under the United Nations Framework Convention on Climate Change in 2015.

Guterres said the report presents "an atlas of human suffering and a damning indictment of failed climate leadership," which has ignored the fact that nearly half of humanity is living in the climate danger zone right now, and many ecosystems are already at the point of no return.

"This abdication of leadership is criminal. The world's biggest polluters are guilty of arson of our only home," he said. "It is essential to meet the goal of limiting global temperature rise to 1.5 degrees. Science tells us that it will require the world to cut emissions by 45 percent by 2030 and achieve net zero emissions by 2050."

Overshooting the 1.5 Celsius Goal Poses a Huge Risk

Ecologist Camille Parmesan, one of the lead authors of the report, said it shows that climate impacts will arrive faster and be "much more widespread than we thought." The science assessed for it by the IPCC opened "a whole new realm on infectious diseases emerging in new areas," and documents species extinctions and mass mortalities of mammals caused directly by climate change. Local losses of key species are already affecting the stability and integrity of ecosystems, according to Parmesan. Even to the authors, the intensity of some impacts from the current level of warming were surprising and disturbing, she said. Insect-ravaged forests, dried-up peatlands and "even intact, undisturbed Amazon rainforest" are losing their ability to remove carbon dioxide from the air, she said. "Maybe not every year," she continued, but at a pace that could further accelerate warming.

Meanwhile, global emissions are still going up, and the panel's report warned how risky it would be to shoot past the Paris agreement goal and rely on unproven carbon dioxide removal technologies to reduce the temperature quickly.

"We are concluding that going above our targets would increase risk of irreversible impacts," Parmesan said, while other impacts would be "difficult to reverse after overshoot."

In the United States and North America, the report says that many millions of people in every sector and in every region are feeling the effects of climate change "much faster and more severely than we previously thought," said co-author Sherilee Harper, a public health and climate researcher with the University of Alberta.

The IPCC report also acknowledges that the reaction to the climate crisis "was slowed by misinformation around climate science," she added. Consequently, many adaptation efforts are still just in planning phases when implementation is urgently needed.

New research assessed by the panel shows that warming is

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Finding and Redressing Flood Risk Inequities

Michael J. Daley

Even with a heroic effort to turn every bit of cropland, pasture, hay field, and barren ground into forest, a unique study of flooding in the Lake Champlain watershed by University of Vermont (UVM) scientists generated sobering news: such a massive change in use of the land would only prevent about 20% of the predicted damage climate change induced flooding will cause during the next 100 years.

Also, the benefits of such drastic intervention would mainly accrue to high value property owners leaving most mobile home dwellers, low-income people, and the disadvantaged, well, down the river without a paddle.

On July 29, 2021, rainfall and subsequent flooding caused a significant landslide dangerously close to a young family's home. (Photo: Joseph Endris.)

A paper describing the study titled, "Inequities in the distribution of flood risk under floodplain restoration and climate change scenarios," appeared in the British Ecological Society journal *People and Nature*. A UVM press release announcing publication quotes lead author Jesse Gourevitch, "This research shows that the Vermonters least able to prepare and recover from flood damages disproportionally face the greatest threat."

Fortunately, in a separate but relevant development last year, the Vermont Legislature established the Flood Resilient Communities Fund (FRCF) in an effort to correct some of these disparities. The FRCF focuses on buyouts of flood vulnerable properties, emphasizing projects that prevent repeated losses for low-income and marginalized Vermonters. Applications for the third round of grants are due by October 2022 with $4.6 million in funding available. While Gourevitch and team focused their first study on Lake Champlain, they say their new model can be of help to a wide-range of communities in determining what areas and citizens are most vulnerable to flooding.

Among all the increasingly frequent and severe disasters we face due to climate change, the paper notes research indicating that, "Flooding is the most widely experienced, deadliest and costliest natural hazard in the United States and globally. Already climate-change-induced increases in extreme precipitation events have contributed one-third of flood damages incurred in the U.S. between 1988 and 2017, with a cumulative impact of $73 billion."

In hopes of providing policymakers with a tool to better target flood mitigation efforts, Gourevitch and four other colleagues associated with Gund Institute, developed a model to predict not only dollar damages, but to whom and where the damage might occur. Previous models rarely put these two elements together. For their pilot study, they chose five Vermont watersheds of Lake Champlain: the Lamoille, Mattawee, Missiquoi, Winooski and Otter Creek rivers.

First, they generated a baseline as if no climate change was happening. They then modeled expected climate-change impacts. Finally, they modeled a maximum imaginable flood mitigation effort. The authors state, "To simulate floodplain restoration, we converted cropland, pasture, hay and barren land cover classes to deciduous forest...this approach was designed to estimate the upper bound potential of floodplain restoration through reforestation"

The result?

"Over a 100-year time horizon [period – ed.], we estimate that the value of property damages caused by flood inundation is approximately $2.13 billion under the baseline scenario. Climate change is expected to increase damages to $5.29 billion, a 148% increase; however, floodplain restoration has the potential to reduce these impacts by approximately 20%."

In email communication with this reporter, Gourevitch acknowledged that any real-world mitigation efforts would not reach the model's ideal, thus damage reductions would be less than 20%.

In addition, modeling revealed that even this modest damage reduction mostly benefited high value properties. Simply put, a flood event that trashes a mobile home while also flooding the basement of a million-dollar home is not the same kind of catastrophe for each homeowner. Yet the more costly damage drives many flooding analysis and damage awards.

The authors note, "This bias in monetary valuation is codified by FEMA's hazard mitigation assessment methodologies, through their use of benefit–cost analysis. In the absence of equity weighting, these methodologies create perverse incentives in prioritizing flood mitigation interventions, whereby wealthier property owners often receive greatest protection."

This shortcoming no doubt influenced Vermont legislators to create the FRCF. Experience with disaster recovery after Irene revealed many instances of inadequacy in FEMA reparations. Many of the first round FRCF grants awarded directly seek to help people who fell through the cracks, such as a young family in the Town of Rockingham whose home became dangerously unsafe due to a landslide. Of the nine municipalities awarded grants in the first round of submittals, five were to finance buyouts of flood prone properties.

Third round FRCF applications are due by October 2022 and are open not only to municipalities, but non-profits, and others. Vermont Emergency Management Director Erica Bornemann is encouraging eligible applicants to "think creatively about what types of projects could make a difference in their communities."

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.

Source links available in the posting of this article at: greenenergytimes.org. ♻

Leah Wittenberg has been making environmental and political cartoons for 30 years. (leahwittenberg.com)

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already "stressing agriculture in North America, with generally reduced agricultural productivity and greater losses heading south from Canada to Mexico," said co-author Rachel Bezner Kerr, a global development researcher at Cornell University.

"Over all the picture is stark for food systems," she said. "The transformative changes we need are not happening to support adequate food production."

It all adds up to more lost lives and devastated livelihoods around the world, Guterres said, calling for a renewed worldwide effort to stop global warming.

"Every country must honor the Glasgow pledge to strengthen national climate plans every year until they are aligned with 1.5ºCelsius," he said. "The G20 must lead the way, or humanity will pay an even more tragic price."

War Devastates the Climate and International Efforts to Preserve It

But it's unlikely that the G20—made up of the nations with the largest economies in the world—will step up more on climate when it is distracted by a conflict involving one of its members that threatens to draw in others.

"War is terrible for emissions and for ecosystems and terrible for multilateral engagement," Schoonover said. Yet **the** conflict is already threatening to exacerbate some of the effects of climate change highlighted by the new report.

"I'm really concerned about the impacts to food production in Ukraine," he said. The country is a key source of grain for parts of the Middle East that face grain shortages because of global warming, showing how global warming impacts and conflict can intensify each other.

Russia's aggression and its duplicity leading up to the attack may also call into question whether the country's promises to fight global warming under the Paris agreement mean anything. Vladimir Putin is not an overt climate denier, Schoonover said, but has made clear that he intends for Russia to develop all of the nation's climate-warming fossil fuel reserves, including in dangerous and sensitive environments like the Arctic, and he may be prepared to use force to assert other territorial claims for fossil fuels.

But the invasion could also spur a climate-beneficial backlash by hastening the switch to clean energy by Europeans shocked by the invasion and eager to reduce their dependence on Russian fossil fuels, Schoonover said. Europe does not want to be dependent on gas from North America, either, and building new fossil fuel infrastructure to facilitate delivery would lock in more harmful emissions.

Sending a fleet of liquid natural gas tankers from North America to Europe during an active conflict may be asking for trouble, and would require ramping up military operations to protect the tankers, potentially expanding the conflict and further warming the climate with the emissions from the millions of barrels of oil required to fuel the tankers and any escorts they may require. The U.S. military is already the single largest institutional consumer of oil.

"I know people everywhere are anxious and angry. I am, too," Guterres said of the growing anguish over global warming. "Now is the time to turn rage into action. Every fraction of a degree matters. Every voice can make a difference. And every second counts."

Bob Berwyn an Austria-based reporter who has covered climate science and international climate policy for more than a decade. Previously, he reported on the environment, endangered species and public lands for several Colorado newspapers, and also worked as editor and assistant editor at community newspapers in the Colorado Rockies. Follow Bob on Twitter @bberwyn

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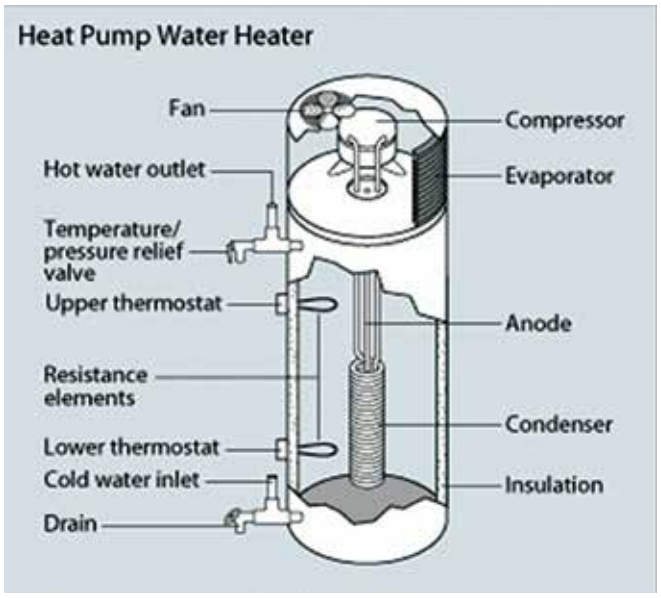
Solar H2O and Heat Pump Water Heaters

Russ Lanoie

Other than capturing the sun through windows for passive solar heating, for many years the most effective way to utilize the free energy of the sun was with a solar hot water system. For years organizations sparked by the Plymouth Area Renewable Energy Initiative, PAREI, helped local homeowners install solar hot water systems in barn raiser fashion.

With the changing emphasis to solar electric installations, solar hot water systems have given way to a new technology that can harness the energy of the sun to produce hot water in a very different manner.



This new twist with heating domestic hot water is electric water heaters with heat pump technology built in. This means that the heater uses electricity to take heat from its immediate environment and transfer it into the water rather than use only a built-in electric heating element as do most electric water heaters. As with other heat pump systems, this makes the system two to three times more efficient than a traditional electric water heater by using one unit of energy to produce two or three units. It uses the same technology that is popping up everywhere in the form of "mini-split" heat pump systems with the largest component of the system, the compressor, outside the house, and one or more "heads" that transfer the heat or cooling remotely.

During extremely cold periods, mini-splits heating a building might have to rely on fossil fuel backup heating, because when they are working in an extremely cold environment their efficiency drops back to performing like any other electrical resistance heating unit with one unit of energy in and one unit out. Because water heaters seldom operate in sub-freezing temps, there should never be a time that a heat pump water heater should ever lose an effective level of efficiency. During periods of high demand, heat pump water heaters can be set to supplement that demand with a backup standard electrical coil built into the tank.

There are several advantages to this type of water heater besides its increased efficiency including that it can help cool the inside of a building in summer by taking the heat from the room where it is located and transferring it into the water, and also that it can use electricity from a building's PV system resulting in another way of using the sun to heat water. It is worth considering that several states and utilities provide rebates for heat pump water heaters.

A disadvantage of a

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BioHeat To Replace Home Heating Oil

George Harvey

Most people in this country drive cars, and most of those cars have internal combustion engines that burn fossil fuels. Many people who care about climate change and the environment still burn gasoline for transportation. The reason is clear. We cannot all go electric at once. There aren't enough electric cars, and there wouldn't be enough electricity to run them all, if they were all we drove.

The situation for heating is similar. Here in the Northeast, most homes use natural gas, oil, or propane for heat. If we all decided to convert to electric heat tomorrow, we would not be able to do it. Today's heat pump technology still needs improvement, there aren't enough skilled installers to put them in, and the grid would not be able to supply enough electricity to keep them going.

Clearly, it will be necessary to keep large numbers of oil burners going for some time. It is not something that we have a choice about. This is just the way things are.

Fortunately, there are alternatives to using fossil fuels for oil burners. These are mostly made up of biodiesel blended fuels, which are made from various fats and oil, with the specifics of the fuel dependent on both the supplier and the use. Among the many feedstocks used to produce Bioheat® fuel are soybean oil, used cooking oil, animal fats, distillers corn oil and canola. The equipment burning such oils ranges from diesel cars to home heating oil systems. The renewable fuel is produced through transesterification to chemically produce biodiesel meeting ASTM standards.

The advancement of biodiesel will decrease our country's dependency on foreign nations for energy, reduce carbon emissions and support the American agricultural sector.

Main-Care delivery truck. (Courtesy image)

A truck is being loaded with Bioheat® at the Bourne's Energy plant. (Courtesy image)

Biodiesel is usually blended with some percentage of diesel fuel or heating oil.. The blend is named according to the percentage of biodiesel in it. So, for example, B10 indicates that 10% of the oil is from biological sources. It can be used as a drop-in replacement for diesel oil and managed similar to conventional diesel and heating oil.

Levi Bourne, President at Bourne's Energy said, "At the Bourne's Energy plant we can blend any blend of biofuel using recycled cooking oil and feel good that this fuel is produced locally for our Vermont community. It's biodegradable, nontoxic, and ecologically the best and highest use of waste vegetable oil. It's a full circle and since it doesn't require any additional investment or change to your equipment, it couldn't be any easier to reduce your carbon footprint with biofuel."

In 2019, at the National Energy and Fuels Institute conference the heating oil industry unanimously resolved to fully embrace Bioheat® and increase the percentage of biologically derived fuels to 50% by 2030 and to the point it hits net zero carbon emissions by 2050.

It happens that home heating oil and diesel fuel are nearly identical in their makeup, so it makes sense to use biodiesel for heating a home or business instead of traditional fossil fuels. In this way, the carbon emissions from heating can be reduced without any change or additional investment to the heating system.

We should be clear about this. For nearly any application where home heating oil is used, the carbon footprint of heating the building can be reduced quite a lot by simply changing the blend of oil that is used.

To assess the implications for a particular home, we must consider several factors. First of all, we should think about the age and condition of the current heating system. If an oil-burning furnace is really on its last legs and needs to be replaced, that is one thing. But if the heat is coming from a new, high efficiency oil furnace, that is another altogether, because it has its own embodied energy, so air sealing and insulation might be better uses for money than putting in a new heating system. In that case, it would make perfect sense to reduce the carbon footprint of the fuel by going to a blend with less fossil fuel in it.

For *Green Energy Times* readers Main-Care Energy and Bourne's Energy supply Bioheat®. Main-Care covers regions in northeastern NYS and areas in VT near Bennington and Rutland. Bourne's Energy supplies Bioheat® to Vermont. ♻

NEW YORK GEOTHERMAL CONFERENCE

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NY-GEO Renewable Heating & Cooling Conference
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NY-GEO's mission is to grow the geothermal heat pump industry and develop its workforce, while educating policy makers and residents about the benefits of geothermal heat pumps.

The theme for this year's conference is "Electrify with Heat Pumps."

The keynote speakers are: **Dr. Luis Aguirre-Torres**, director of sustainability for the city of Ithaca, NY and **Rory Christian**, Commissioner of the NY state public service commission.

To learn more about the conference and register, visit https://bit.ly/NY-GEOconference2022.

SOLAR HOT WATER *– Cont'd from p.26*

heat pump water heater is the fact that it is taking heat from its environment which might be fine if it is in a room with a wood stove or 'alternative'-fueled furnace, but not if it is stealing heat that is generated by an expensive non-renewable energy source, in my opinion.

As for the future of stand-alone solar hot water systems, the complexity and expense of a system appears to make little economic sense when compared to a PV powered heat-pump system. On the other hand, keeping an existing solar hot water system operational makes abundant sense so long as major components do not need replacing. Unfortunately, there are existing solar hot water systems that are not functioning simply because of a minor component that a subsequent homeowner or an unfamiliar plumber does not have the wherewithal to troubleshoot.

We've found that solar raisers from years ago served to take away the mystery of solar hot water for the several plumbers who took part as they came to realized that solar hot water systems are little more than any other domestic hot water system except that the source of the heat was the sun beaming on solar collectors instead of some kind of gas or oil-fired system or some wires hooked to the grid.

Russ Lanoie is a long-time solar proponent in New Hampshire's White Mountains and operated his Alternative Systems business in the 1970s—80s selling solar hot water systems, composting toilets and Window Quilts®. He lives in a passive solar home which has had Daystar solar hot water for forty years and 11kW of PVs on his barn since 2015. www.RuralHomeTech.com. ♻

A Bunch of B.S.* (*Building Science, of course!)

The Next Frontier in Sustainable Building: Deep Altruism

Nate Gusakov

For the last few decades, most of the leading discussion, innovation, and progress towards a more sustainable building industry have been centered on reducing operational energy use. In other words, learning how to make buildings use less energy while they keep people at the same level of comfort. More insulation, better air-tightness, innovations in appliance efficiency, siting and glazing for solar gain…all of these are geared toward helping buildings use less in their day-to-day operations. Less oil, less natural gas, less coal, fewer electrons – it's the same idea across the board. To some people (probably many of whom are readers of *Green Energy Times*), there is a great deal of global consciousness and eco-awareness behind this work. However, the larger part (by far) of the building industry is mostly motivated by the good ol' bottom line. Spending less money to get the same result is, and always will be, an excellent selling point. So, it should have been a snap for the mainstream building industry to see widespread adoption of technologies that absolutely maximize reductions in operational energy use, right?

Green Building pays off reducing global atmospheric carbon levels and the resulting potential reduction in the severity of climate change. (Flickr)

Well, let's try to measure. One simple way to measure a building's annual energy use is with a metric called Energy Use Intensity (EUI). It's expressed in thousands of BTUs per square foot of floor space, or annual kBTU/ft2. For example, the most stringent of today's building standards (certification by the Passive House Institute of the US or PHIUS), requires an EUI of slightly less than five kBTU/ft2. However, the latest available numbers from Efficiency Vermont show that the average VT home currently has an EUI of over 64 kBTU/ft2, and the latest numbers from www.energystar.gov show an average EUI over 86 kBTU/ft2 across all U.S. building sectors! This means that on average our buildings use 1500% more energy than the levels we are capable of! We are obviously still a far cry from selling everyone in the industry on maximizing reductions in building energy use.

Now that we're into the 2020's the discussion at the forefront of sustainable building practices is changing. Increasingly over the last five years or so, if you've spent any time at a regional sustainable building conference (NESEA's Building Energy Boston, or Efficiency VT's Better Buildings by Design, for example) you'll have seen lots of attention paid to the topic of embodied carbon (EC). This is the overall amount of CO_2 released into the atmosphere during the creation, transportation, assembly, maintenance, and decomposition of a product or material (usually expressed in kilograms of CO_2 per kilogram of product or material). If you subscribe to the global scientific understanding of the causes and dangers of atmospheric climate change, then you can understand why embodied carbon is such an important topic. Regardless of how many dollars or BTU's a certain material will save during its time in a building, if more CO_2 emissions are thrown into the atmosphere just during its manufacture and transport than it will eliminate during its lifetime, we have a losing proposition. Add to this the fact that operational savings take years to accumulate while EC represents emissions that have already happened before the building is even finished, and you can see doubly the importance of paying attention to EC.

> Over the last five years, if you've spent any time at a regional sustainable building conference (NESEA's Building Energy Boston, or Efficiency VT's Better Buildings by Design, for example) you'll have seen lots of attention paid to the topic of embodied carbon (EC).

Ok, so where am I going with all this, and what does it have to do with 'deep altruism' (whatever that is)? Here's the thing – even with very direct bottom-line savings as a marketing tool, significant reductions in EUI have been slow to spread, even across decades. *Why* that's the case is a big long snarly question, and not one that I'm getting into here. Regardless, it's true. And now the conversation needs to change (broaden, really) to include EC concerns as well. The big catch: there's very little immediate, tangible benefit to minding our EC. It is often *more* expensive to achieve low-EC construction goals (although that's changing by the moment), and the truest return on investment is clearly not going to be realized for many, many years. If and when there is a payoff from the hard work of tracking and minimizing EC, it will come in the form of reduced global atmospheric carbon levels and the resulting potential reduction in the severity of climate change. That is the currency. The return on our investment will be the possible alleviation of future suffering of other living beings who may or may not live their lives far away from us in place and in another time. Perhaps to those with a more indigenous world view, used to taking into account the effects of their actions on life seven generations later, this is not news. As for the rest of us, well friend, this is not a bottom line that most corporations (or homeowners, for that matter) are keeping on their spreadsheets, and that's got to change. In order to invest ourselves truly in EC issues at a significant level right now, the actions of the entire building industry will need to become altruistic beyond our current imaginations. I call that deep altruism, and I wish us luck.

Nate Gusakov is an air-leakage specialist and building envelope consultant who aspires to be like Friar Tuck in the Sherwood Forest of modern building science. ♻

Warm and Cool Homes Built in New Hampshire

Wes Golomb and Bob Irving

This is the first 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.

The 10kW solar array provides enough electricity for the demands of the house. (Photos: Wes Golomb)

A net-zero home is built to be airtight and efficient with enough electrical generating power to supply the home's energy needs. This requires an overall strategy for our society's transition from a fossil fuel to a sustainable energy economy. I call it the three-legged-stool approach.

The first leg of the stool is efficiency. We use as little energy as absolutely needed to accomplish a task. A net-zero home achieves efficiency through a series of air, moisture, and thermal barriers built to keep heat and moisture where we want them and to eliminate infiltration of outside air.

The second leg is electrification. We use only electricity instead of fossil fuels. This approach generally saves at least a third of the energy needed. High efficiency homes replace the combustion of fossil fuels with heat pumps, which use a technology similar to a refrigerator to heat or cool efficiently, as needed. Gas cook stoves can be replaced by equally fast induction stoves.

The third leg of the stool is to produce all the electricity we need to with sustainable energy. Thanks to their precipitous drop in costs, this means we are able to use solar photovoltaics (PVs) to supply our electricity.

Let's look at the general strategies used by net-zero home builders, and how they were applied to Mike Marion's home in Newmarket, New Hampshire.

We start with efficiency. Designers of high-efficiency homes take a holistic view of the project. This means dividing the job into tasks.

The first task is to define the building "envelope" which includes the surfaces that provided the air, moisture, and pressure boundaries between conditioned inside space, and the unconditioned outside. The keys to a highly efficient home are air-sealing, effective insulation, and controlled ventilation.

Minimizing infiltration is critical so it is important to seal every penetration into the house including the sill. To do this, we use a blower door test to measure how air-tight a house is, and we test prior to insulating so problems can be fixed. (THIS IS CRITICAL!!!)

To do the blower door test, we put a large fan into a door, air-sealing it to the frame. All the doors and windows are closed, and the fan is turned on blowing air out of the house. This lowers the air pressure inside, relative to the outside pressure. When the house has been depressurized to -50 Pascals (Pascals are a measure of air pressure), the amount of air being pulled through the fan is measured. From this information, the number of air changes per hour (ACH50) is determined.

Mike Marion's home tested at 0.6 ACH50. This is less than a tenth of the NH standard of 7 ACH50. It is good for a net zero home, as they generally get less than 1 ACH50.

Double wall framing allows the space for the 10 inches of the blown-in cellulose insulation.

The basement walls of the Marion's home were poured and then rigid foam insulation was installed on the inside to minimize moisture

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The joints of sheathing on the walls were air-sealed with 3M tape.

Tamara Boise, with a new electric Zero motorcycle

Efficiency Vermont's Efficiency Excellence Network (EEN)

Contractor Spotlight: A Look Inside

Interview with Bryn Oakleaf, the Efficiency Excellence Network (EEN) Program Manager

G.E.T. *Staff*

G.E.T.: How did you become interested in energy efficiency work?

Bryn Oakleaf: I started working for Efficiency Vermont in 2019 after many years working for state government in environmental policy roles. I was drawn to working with Efficiency Vermont for their cutting-edge programs, direct benefits to Vermont customers, and core values.

What types of contractors and suppliers do you primarily work with?

BO: EEN members include builders, architects, HVAC contractors, weatherization contractors, equipment suppliers, electricians, lighting designers, and more. These members provide services to both residential, commercial, industrial and institutional customers. The EEN also recently expanded to include electric vehicle dealerships starting in the fall of 2021. Through the EEN, we are able to provide both a skilled workforce, and dedicated supply chains stocking energy efficient products to complete projects with.

How does your work with the Efficiency Excellence Network help meet customer needs?

BO: My work managing the EEN helps customers find skilled contractors not only to complete their project, but who are familiar with Efficiency Vermont incentives to lower costs and help finance projects. The Home Energy Loan is a great asset to residential customers looking to finance projects at 0% interest up to $20,000 for eligible projects. This benefit is only available to customers using contractors in the Efficiency Excellence Network. In some cases, program-specific rebates are only available when using EEN members such as Home Performance with Energy Star projects, often called weatherization projects.changing to meet the needs of our customers.

What resources are available to help someone just beginning to learn about services that the EEN provides?

BO: You can find Trade Partner information on the Efficiency Vermont website here: https://www.efficiencyvermont.com/trade-partners. Our Find a Pro tool https://www.efficiencyvermont.com/find-contractor-retailer is another excellent way to see the variety of companies in the EEN and the numerous energy efficient services they provide. Our rebates page also indicates whether an EEN

Why should a customer use an EEN member for their project or service needs?

BO: Customers that utilize EEN members can have confidence that their contractor has baseline experience for the service they're listed for on our website. They can also be assured that the contractor is paired with an Efficiency Vermont specialist to assist them with questions on eligibility for project incentives to minimize expenses and make their dollars go further.

What are some questions you recommend customers ask when working to meet their energy efficiency goals?

BO: Customers should start the process of finding a contractor early in their planning. It's good to reach out to multiple contractors to ask what their lead times are, and estimated time for project completion. This will give customers an idea of how contractor capacity fits into their personal timeline. Customers may also want to see if sub-contractors are needed for any aspect of the work too. For example, heat pump installations often need an electrician to complete the project. Knowing if a subcontractor is used will also help with timeline expectations. Lastly, it's good for customers to ask about operation and maintenance to optimize their project. This will differ from weatherization projects to HVAC related projects and can help ensure customers know what to expect, including estimated frequency of maintenance.

Any additional thoughts about the EEN that would be of interest to customers?

BO: The EEN is comprised of skilled and talented trade professionals committed to energy efficiency design and operation of our built spaces. They are the backbone of meeting, and exceeding, state climate goals and reducing utility costs of Vermont businesses and residents. ♻

Getting to Net-Zero Everything: Part 3

Sara Gutterman

This three-part blog series outlines the urgent need to transition to achieve net-zero energy, water, and carbon. This final installment explores how the quickening pace of our climate emergency demands we reach full-scale elimination of carbon emissions.

The transition to the decarbonization economy will effectively require a complete overhaul of our socio-economic system. We won't be able to shoehorn sustainability into old systems, meaning that we have the rare and thrilling opportunity to redesign our economy at a scale and scope that equals the transformation brought about by the Industrial Revolution.

While recent climate reports issued by the United Nations and scientists across the globe are soberingly dire, many of the world's best minds are focused on mitigation and adaptation solutions.

The transformation will be scary for some – namely, those who cling to antiquated business models, obsolete energy sources, and outdated technologies. They will fight, attack and fashion every conceivable obstacle possible to impede progress.

But just as earlier naysayers couldn't suppress the adoption of breakthrough innovations like indoor plumbing, incandescent lights, or the combustion engine, efforts to hinder progress will ultimately be futile.

Our world is evolving into a cleaner, greener, and better version of itself, and the good news is that all of us – including even those that launch the most vigorous assaults on advancement – will reap dramatic rewards.

We will all enjoy clean air, fresh water, fertile soil, protected species, vibrant ecosystems, social justice, and a flourishing economy that is not only free of carbon emissions, but that also offers opportunity for incredible capital gains for those with just a little ambition and imagination.

While this utopian vision may seem idealistic, improbable, and out of reach, I am convinced that it is the inevitability of our species and the next stage of our evolution.

Roadmap to Decarbonization

Getting to net-zero carbon will require an inspired, novel, multi-pronged approach, with strategies ranging from simple, nature-based solutions like planting trees to deep energy retrofits to the deployment of complex enabling technologies.

Essential tactics include:

- Sequestering existing emissions in the atmosphere through the protection of forests, oceans, and other critical habitats.
- Driving renewable energy adoption; investing in super-efficient solar, wind, and battery storage technology; and implementing a national clean energy standard that requires utilities to derive increasing amounts of electricity from carbon-free sources.
- Transitioning the entire built environment to net zero and all-electric by implementing energy efficiency retrofit programs and ratcheted codes, mandates, and incentives.
- Electrifying transportation, requiring that all new vehicle sales be electric and implementing a "cash for clunkers" trade-in program to incentivize the transition to clean vehicles.
- Reimagining industry and manufacturing, primarily in highly resource-intensive and polluting categories like cement, steel, chemical, and paper.
- Transforming agricultural practices to reduce the impact of food production and preserving more land that can be used for carbon sinks.

With the net-zero commitments that these institutions have recently established, those dollars are now being shifted into the burgeoning areas of carbon tech, climate tech, renewable energy systems, battery storage, and the electrification of homes and buildings.

Decarbonizing the Built Environment

The built environment plays a major role in carbon emissions. The sourcing and manufacturing of materials, construction, and operations of homes and buildings require an immense amount of energy and emits a substantial amount of pollution.

The Department of Energy (DOE) estimates that homes and buildings in the U.S. account for 40% of our nation's total energy use, 70% of electricity use, and 40% of total emissions.

To give you an idea of the scale of the financial opportunity, Moody's estimates that G20 financial institutions have nearly $22 trillion tied to carbon-intensive industries, representing nearly 20 percent of their portfolios.

It is estimated that if all buildings were net-zero embodied carbon (including the manufacturing, transportation, construction, operation, and end-of life-phases), then the United States could reduce its greenhouse gas emissions by more than 50%.

On a global scale, the UN avows that emissions from buildings must be reduced by 50% by 2030 and 100% by 2050 if we stand a chance at staying under a 1.5-degree temperature rise. Lamentably, we have a long road to travel—not even 1% of existing buildings are considered net-zero carbon today.

Fortunately, pioneering materials and technologies are being developed that will expedite the transition to net-zero carbon in buildings, offering sustainable solutions in high-intensity categories such as concrete and steel.

For example, 3D Graphene is a 3D-printed lightweight porous foam made of carbon that is reported to be 5% of steel's density and 10 times its strength, making it an excellent, sustainable replacement for steel in skyscrapers and tall buildings, and self-healing concrete has a water-activated bacteria that reacts with starch to produce calcite to repair cracks, increasing the estimated lifespan of concrete by over 200 years.

Clean Electric Technologies

To get to net zero, we need a full-scale adoption of renewable energy, as well as the adaptation of infrastructure, regulations, and financing to support this transition.

Fortunately, the clean energy future is already here. Wind and solar energy are now cost-competitive in most parts of the world, and clean energy technologies can now harvest more power using less space and fewer resources than ever before.

In fact, power sourced from wind and solar is now less expensive than power produced by fossil fuels on a national scale, and it is now less expensive to build new onshore wind and utility-scale solar power generation facilities than it is to operate existing fossil fuel facilities in many markets.

The adoption of clean energy technology is leading to the transformation of electric-grid architecture. Power generation is becoming more distributed and localized, with enhanced load management and optimized demand-side energy management.

The Internet of Things (IoT) is enabling intelligent devices to remotely manage everything, from manufacturing to building operations to vehicle fleets to power grids, with the goal of optimizing efficiency, while Artificial Intelligence (AI) technology is monitoring cybercrime to enhancing digital security across grid networks.

Advances in battery storage are also enabling the transformation of our power systems, further facilitating peak load shifting and enhancing the resiliency of the built environment.

The cost per watt-hour of battery storage has decreased by approximately 70% since 2015, which is not only helping to fulfill the promise of distributed energy generation but is also spurring a revolution in vehicle electrification.

Some experts predict that economies of scale will bring down the cost of batteries to allow electric vehicles (EVs) to reach price parity with gas-powered vehicles by as soon as 2024, increasing the number of EVs on the road to 550 million globally by 2040—up from 13 million vehicles today.

Vehicle-to-grid technology, or the ability to store power in EVs and feed it back to the electrical grid when demand is high, is also evolving, taking its rightful place as an essential tool for optimized demand-side energy management. Smart charging software and bidirectional chargers not only allow EVs to draw power from or feed power back to the grid, depending on demand, they also enable EVs to serve as a backup power source for homes and buildings during emergencies and blackouts.

Carbon Tech Transforms Greenhouse Gases

Another burgeoning industry that is facilitating the transition to net-zero is Carbon Tech, technology capable of capturing and embedding large amounts of carbon into products and materials.

Companies throughout the economy are getting creative about keeping greenhouse gas emissions out

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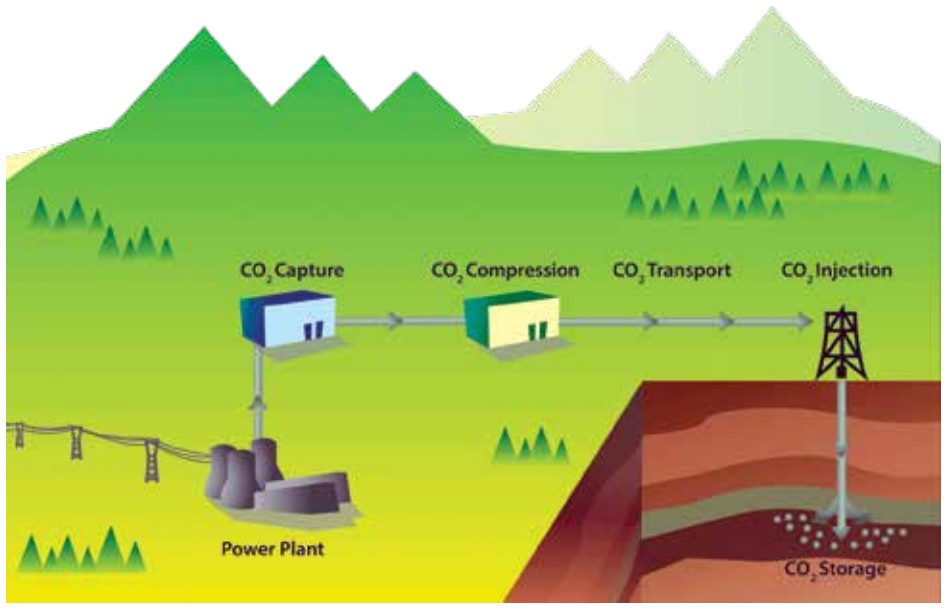
of the air from industrial and manufacturing activities, as well as capturing existing CO2 particles and repurposing them into a useful input material.

Companies like Carbon Engineering and Climeworks are removing CO2 from air using massive fans and storing the gas permanently underground in a process called Direct Air Capture.

CarbonCure is injecting CO2 from factory exhaust into a cement mix so that it can mineralize in concrete—an essential innovation given that concrete production is one of the most intensive processes in our entire economy, accounting for approximately 7 % of annual global CO2 emissions. Not only does this process reduce emissions, the addition of the CO2 yields a stronger concrete material.

By using carbon, these companies are turning harmful greenhouse gas into valuable raw material, offering utilities, manufacturers, and other carbon emitters a much-needed economic incentive to capture carbon particles rather than release them into the atmosphere.



One idea for decarbonization is carbon capture where CO2 is removed from air using massive fans and storing the gas permanently underground in a process called direct air capture. (pubs.rsc.org)

All Hands-on Deck for Decarbonization

When it comes to reaching net zero, a new wave of consumers is driving the bus. Imbued with an inherent ethic of sustainability, millennials and Gen Zs are facilitating market transformation, making a decarbonized future inevitable.

In a recent COGNITION Smart Data survey of this influential audience segment revealed that:

- 86% of females and 81% of males responded that they prefer to buy products from companies that demonstrate a strong commitment to sustainability.
- 77% of millennials are willing to pay more for sustainable products.
- 79% of millennials are concerned about the environmental impact of products they buy.

In response to mounting public pressure, multinational corporations have entered a fierce competition to become the sustainability leaders in their sectors, pledging to become net neutral with respect to energy, water, materials, emissions, waste, operations, packaging, and mobility within the next decade. Sustainability is now a moral imperative, driving business strategy, innovation, and sales.

Companies large and small are finding ways to solve for mounting environmental challenges. Behemoths Amazon, Best Buy, IBM, Philips, Schneider Electric, Unilever, and Verizon have all pledged to reach zero carbon by 2040.

Companies like Whirlpool and Facebook have made global commitments to reach net-zero emissions in plants and operations and convert to 100% renewable energy by 2030.

Automotive companies like Volvo and GM have pledged to electrify their entire product portfolios by 2040, while simultaneously eliminating carbon from their manufacturing, operations, and supply chain, sourcing renewable energy, and purchasing carbon offsets.

Microsoft has not only committed to becoming carbon negative by 2030, but it has also pledged to remove all of the carbon the company has emitted since its inception.

And, of course, the private sector can't go it alone—governments will play a pivotal role in the shift to net-zero carbon through:

- Programs and policies that bolster green infrastructure, research, and innovation.
- National mandates for renewable energy and electrification.
- Incentives for energy efficiency upgrades.
- Reduced emissions from agriculture.
- Lowered toxic emissions from industrial processes and manufacturing (including CO2, methane, hydrofluorocarbons, and other potent climate pollutants).

The United States has recently set aggressive targets to become net-zero carbon by 2050. China has pledged to cut carbon emissions by over 65% by 2030 and become carbon-neutral by 2060. India has committed to reaching net-zero emissions by 2070.

France, Britain, China, and India have all announced intentions to phase out combustion engine vehicles as early as 2035. Germany has shifted to primarily renewable energy and decreased its emissions by 23% since 1990.

Britain has dropped its emissions by an impressive 43% since 1990, including a 65% decrease in its power sector emissions resulting from the phase-out of coal and super pollutants like methane and hydrofluorocarbons.

Emissions Reduction Must Happen Now

While these commitments are certainly encouraging, the reality is that they're not enough to keep us below a 1.5-degree temperature increase.

According to the UN, current climate commitments would only cut global greenhouse gas emissions by approximately 1% by 2030—a frighteningly far cry from the 45% cut needed to limit global warming to 1.5 degrees.

In fact, at our known and foreseeable rates of progress, we're expected to surpass 2 degrees Celsius within a shockingly short five years.

With climate change wreaking havoc across the globe, reaching net zero has become an absolute imperative, and the window for action to safeguard our planet is closing fast.

As we race against the clock and more people wake up to the reality of our climate emergency, expect the pace of change to accelerate.

Make no mistake, the revolution has begun.

To learn more about getting to net-zero energy, water, and carbon, watch Green Builder Media's webinar at https://bit.ly/GBM-webinar.

Sara Gutterman is the cofounder and CEO of Green Builder Media.

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RenewAire To the Rescue for Avon Old Farms School

Barb and Greg Whitchurch

Avon Old Farms School is a beautiful, sprawling campus of period buildings, where historic preservation makes technological upgrades challenging. Credit: Avon Old Farms

Remember the spring of 2020? Covid was a "thing." Scientists and health officials say, "Watch Out!" Our top-ranking politicians and other so-called influencers call it a hoax, or at worst a passing cold or flu. And the Avon Old Farms School in Avon, CT approaches the end of their school year with trepidation.

Avon Old Farms (AOF, www.AvonOldFarms.com/) is a boarding school for young men. Among their many and varied responsibilities is the personal well-being of their students, faculty and staff. And they needed to address the pandemic seriously, successfully and SOON --- by the time of school re-opening in the fall.

A primary vector for Covid transmission is air-borne respiratory droplets, so masking of uninfected people is helpful; removing the air-borne virus and replacing it with fresh, filtered air is also very important.

If you've heard of indoor air quality (IAQ) it might have had to do with the unhealthful effects of using propane or natural gas appliances inside of living spaces (schools, homes, etc.; bit.do/gas-cook); or perhaps as it related to smoke from wildfires infiltrating poorly sealed homes; or mold spores inside homes with poorly designed exterior wall systems. But two years ago, it became clear that IAQ was an important factor in fighting Covid, and that balanced, filtered ventilation could help.

Another problem that emerged was that uncontrolled carbon dioxide levels in classrooms or other stagnant air spaces affect thinking and sleeping. High particulate levels (smoke, gas cooking) affect one's ability to resist respiratory infections; other indoor air contaminants are more and some are less dangerous. Modern high efficiency buildings (from Passive House to Energy Star) of all sizes are now designed with carefully balanced energy-recovering fresh, filtered air ventilation systems. RenewAire ventilation equipment is a popular choice in this field.

The school called in van Zelm engineering (www.van-Zelm.com/), a huge firm fully capable of designing a Covid-safe solution that would also greatly improve the overall IAQ of the old buildings.

Van Zelm called in Melia Associates (www.MeliaAssociates.com/) for design assistance and specified RenewAire ventilation systems (www.RenewAire.com/) distributed by RST Thermal (www.RSTThermal.com/). Then they created a plan to address AOF's needs within the extant spaces and constraints - ducting, venting, pass-throughs, etc. RST expedited the RenewAire equipment deliveries.

Not willing to farm out such a delicate operation to others, Glenn Wilcox, director of facilities at AOF and his team performed the actual installation, always with the buildings' preservation in mind. You can find RenewAire's description of the job at bit.ly/renewaire-avon, and a YouTube of the result at bit.ly/renewaire-aof.

Part of Avon Old Farms emergency IAQ solution with RenewAire ERVs.

Far left and right window openings are sacrificed as intake and exhaust for the emergency ventilation system installed in this building to address IAQ in the early stages of the Covid pandemic. (Photos: RenewAire)

But they're not done! All of this was accomplished in just seven weeks, almost two years ago, and although fully effective, the design and equipment were meant to meet an emergent situation as quickly as possible. To avoid unnecessary long-term compromise of the historical architecture, much of the work was left exposed and temporary.

Now AOF is taking the time and spending the money to remove most of the equipment and replace it with new RenewAire systems more tightly integrated with the buildings and spaces so that their appearance is as discreet as possible. So, the original process is to be repeated, but now with everyone familiar with one another and with the experience of having gone through a most thorough dress rehearsal.

The lead of Avon Old Farms can serve as a model for how to approach special-needs projects involving IAQ.

The Whitchurches are owners of a net-zero Passive House in Middlesex, Vermont (bit.do/phc-vtbiz2) and are board members of VT Passive House. (bit.do/mdx-mec-bldg, bit.do/gkw-li). ♻

Warm and Cool Homes – *Cont'd from p. 30*

infiltration.

Above grade, to avoid the problem of thermal bridging (heat loss through the studs and framing.), a second independent wall was built to allow ten inches of cellulose to be blown in. No wood contacts both inside and outside walls, so heat cannot be conducted from warm to cold through wood. The seams between sheathing are taped to air-seal any leaks and form the air barrier. A house wrap was applied to the outside, to help move water away from the siding. LP Smartside claps were installed over the rain screen.

The roof and floors of the Marion home are trussed. Manufactured for strength, trusses avoid the need for load-bearing interior walls, allowing more flexibility in designing the floor plan. The roof of the attic is insulated to R-62 with cellulose.

Triple-pane windows are used throughout.

Now for electrification. The home is heated and cooled with Mitsubishi mini-split air-source heat pumps. It has LED lighting and an induction cook stove.

And finally, we look at the source of electricity. The Marion house has a 10kW PV system, which provides for its electricity needs.

Mike Marion's family moved in in 2017. That year, they spent $1542.16 to heat, cool and supply their electricity. They then installed 10kW of solar PVs. In the winter of 2020-2021 they spent $347.00 to heat, cool and supply electricity. Most of that is the cost of the connection for net-metering with their electric utility.

The Marion's report this is the most comfortable house they have ever lived in.

Wes Golombis a long-time clean energy and climate advocate from Deerfield, NH. He is is an award-winning energy educator, the host of TheEnergyGeek.org and the author of the new book on Net-zero Homes, Warm and Cool Homes.

Bob Irving is the owner of RH Irving Home Builders in Salisbury, NH, specializing in high performance building practices since 1972. ♻

Larry Plesent

Ingredient of the Month
Eating Well for Your Health

Over-the-counter pain reducers (NSAID's) are a $2 billion-a-year industry in the USA, just 11% of the total $18 billion annually spent on pain medication. Over 100 million Americans are in chronic pain. It's time to take a step back and ask WHAT THE HECK is going on here?

One in three Americans adults are in pain every day. Is this normal for humans? Probably not.

So once again your hippy grandmother had it right. If you don't have a hippy grandmother, try to borrow one. Just remember to bring her back.

My hippy grandmother believes in vegetables. She also believes in saturated fats and thinks current food fads and processed convenience meals are hurting people's health. She includes home canned fermented vegetables in her diet and king arthur flour in her bread.

What she doesn't believe in is equally important.

She doesn't believe in bottled water, except in emergencies. And she doesn't believe in sweetened drinks either, except when there is no other decent option available. Like many a hippy grandmother she makes her own Sun Tea by the half gallon glass jug regularly. This makes even more sense once you realize that she has a scientifically justifiable fear of plastics in the food supply.

She does not believe in packaged heat-and-serve food and I agree. Nor in microwaving plastic.

There is always a lot of hype about superfoods and super nutrients. Here are the local superfoods we use in our home.

Cheddar cheese. We pretty much consider this the queen of the superfoods. Our household motto: Chedda makes it bedda!

Eggs. Especially the local ones where the chickens get to go outside. These so-called free-range birds eat the insects they find when they go out to forage. Insects produce essential fatty acids, which are oil molecules that humans have lost the enzymes needed to make them. The birds eat the insects and the magic oil molecules go into the eggs. Voila!

Greens and veggies, cooked and raw. Once you get used to them for breakfast there's no going back. Wash all your veggies with diluted organic liquid soap and rinse well.

Nutritional yeast. I used to take up to one-quarter cup a day when I was run down. Nutritionally dense and high in trace minerals and B vitamins. The bulk yellow flakes at the co-op taste the best and are fortified with B-12. Goes great on eggs. Avoid if gout-prone.

Blueberries. Especially wild blueberries. Another go-to when feeling run down.

Salmon. If I could, I would eat it every day just for the Vitamin D and the essential fatty acids. Maine ocean-farmed is what you want. Coho is highly recommended.

Mason-jar-preserved vegetables. Thars magic in them thar veggies! Especially the ones fermented with salt. The bacteria in them are hugely good for your belly too so do not be afraid. This the good bacteria you heard about on TV. You need it. Go get some. Now.

Rice. Is it really a superfood? No. But it fills you up on the cheap and substitutes for sketchy carbs packaged from the store. Make a pot of rice once a week and incorporate into your meals. It will save you a bunch of hard-earned dollars. How about some rice and eggs with spinach cheddar and nutritional yeast? Yum! Goes great with homemade or bakery-made bread.

Stop by your local co-op and try the bulk soy sauce. It's called tamari there and blows away any other soy sauce you have tried outside of Japan. It's made in the same tank and at the same time as miso, a paste that is used to make a kind of instant soup. Take a heaping teaspoon and put it into a cup. Add three to four ounces of boiling water. Stir and sip slowly. Miso soup is incredibly healing and especially useful when recovering from illness.

Adding cooking lessons to the current school curriculum (taught with a mix of personal hygiene and science) has the potential to boost immune systems, reduce chronic pain, speed healing and improve quality of life across the nation. This educational change reduces long term legal and illegal drug dependency and helps large numbers of people to live socially redeeming lives. Public school cooking classes might just be a government program as helpful to society as universal literacy and sewage treatment plants.

But wait! Did the Soapman just say that hippy squirrel food might actually reduce the need for medicine and medication?

You heard it right. What I am advocating for here is basically a return to the pre-WW2 rural diet. Fresh, local, organic when possible. Just like your Great-Grandmother had. You know, eating what is now called the expensive stuff.

But what is more expensive in the short term usually brings greater returns in the long. It is easier, cheaper and far less painful to lose your taste for processed foods and spend more time and attention cooking fresh, natural and organic ones than it is to end up with a chronic disease.

And you do lose your taste for that type of food. Over time the taste for sweet and salty carbohydrates and chemical preservatives drops away and you start craving fresh stir-fried spinach with your breakfast.

It's pretty simple. You don't build your house out of rotten boards. And you don't build healthy people using rotten food. Let's get it together America! Get out there and take some cooking lessons! Online, offline or by the book it's always a good idea to learn something new.

This is the Soapman wishing you all a happy spring! Get out there and make a mess!

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

Elmore Roots' Permaculture Know-How
Oh –a Pineapple!

David Fried

My brother grows tropical fruit trees in Hawaii. Some years back he drove down our driveway in Elmore, VT and stopped his car. He rolled down his window and said, " I am never going to be cold again." Outside his window the hill is covered with pineapples growing all the way down to the sea. In his orchard are tangerine trees, mangoes, loquats, surinam cherries, malabar chestnuts and much more.

We cannot grow pineapples in Vermont, at least outdoors. But we can grow plums, peaches, persimmons and paw paws. Plums are the easiest to grow. We supplied a local brewery with 2400 pounds of plums last fall from our orchard. We did not have to feed them or spray them or baby them at all. The important thing is to have the right varieties for our northern Vermont climate. If you plant four to six of them or more in one area and mix up the varieties, you can have great success with plums. The American Japanese kinds are the ones we have had the most success with. They have names like "Kahinta, Waneta, La Crescent, Alderman, Toka and Superior." They are the closest things to mangos we can grow in Vermont. Most of my shirts are ruined by the super juiciness that flows from each bite when they are fully ripened on the tree. One light touch and they fall into your open hand when they are ready to be eaten.

Artist: Joyce Dutka

Peaches are beginning to be able to be grown in more areas of Vermont than ever before. This is one of the only advantages of global warming. For many years we have tasted them off trees in Manchester and Burlington, Vermont. In the last few years, some are getting good crops of peaches in Barre and Montpelier and even Calais, Vermont. The "reliance" peach was developed in New Hampshire by professor Elwyn Meader about forty years ago, and it is the most dependable for the warmer areas of Vermont. Some have had success with "contender," and we had fruit on our "monkton" peach last summer, even in Elmore. Life is so peachy when the trees are full and warm with fruit.

Persimmons are small and delectable and native on the east coast. They can be found wild in old Appalachian forest edges and even in Massachusetts they do very well. We have had some nice crops in our high tunnel greenhouse, and I know they grow and ripen well in Burlington, and I am sure some other areas in Vermont. The persimmons grow on pretty large spreading trees and the fruit gets soft and sweet in October, later than most other fruits. I would not try them in colder areas until you have found success with plums and pears, because I would not want you to give up fruit growing until you have tasted some sure harvests first.

Paw paws are this magical fruit that likes to grow in a wild thicket of trees. The leaves are long and exotic like the soursop tropical tree, and they are related to them. In western New York and Ohio and Michigan they are growing all over the place. Some towns have paw paw festivals and make paw paw ice cream and beer. The locals are quite proud of their paw paws. We have been growing them for about twenty years, and they survive all the winters. Only now are we seeing fruit buds on them. Years ago, we saw fruit ripening in Bristol, Vermont and were inspired to try them in Elmore. We later found out that paw paw trees are native to southern Vermont. This is exciting. Sweet flavorful paw paws have been ripening lately in Barre, Vermont.

I love to be a pioneer trying new fruits to grow on our cold hillside. Since we have attempted to grow a lot of things for over forty years here, we can now share with other enthusiasts our successes and failures. I am not recommending growing pineapples in Vermont. But plums, peaches, persimmons and paw paws are fun to grow. Someday you may get some fruit and a story to share about it.

David Fried lives among trees and talks to them and hugs them sometimes. He is a tree whisperer. He also grows and cares for trees at Elmore Roots Nursery and fruit groves. ♻

RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions.

To join this group go to: **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.efficiencyvermont.com**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org

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

SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

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

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

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

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

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

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

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

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

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

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

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Is your home cluttered with unwanted items? Overwhelmed by the accumulation of stuff? Wanting to get organized? A tenant left things behind? **Keep those items out of the landfill. I donate, repurpose, resell, rebuild, reuse, relocate, almost all items if I can. Let's find a new home for your unwanted.**
Blue Collar Cleanouts LLC specialize in the removal of your unwanted items from storage facilities to attics, garages, and rental properties. No job is too big or small. Serving the Upper valley VT and NH.
Email Michael at bccleanouts@yahoo.com with questions, a description and photos for an estimate. Local references provided upon request.

CLEAN ENERGY NH: JOB

Clean Energy NH, the state's leading clean energy advocate, is hiring a full-time Community Energy Coordinator. Provide support to businesses and homeowners in Coos and northern Grafton counties to access programs and funding to complete energy efficiency and renewable energy projects. For more info about CENH and the position visit www.cleanenergynh.org/openings.

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RAINFOREST DEFORESTATION

Help to reduce rainforest deforestation in 2022. Tropical forests are home to over half of the world's plant and animal species, there are more ants to be found scurrying in a single tree in the Amazon basin than across the entirety of the British Isles. Contact Greenpeace, the rainforest trust, text 412-403-2584.

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THE ULTIMATE MIGRANT FARMWORKERS

Birds Outperform Pesticides

Jessie Haas

If you've ever grown fruit or berries, you know the ambivalence farmers feel about birds. A beautiful and essential part of nature, they can also be a pest that eats into crops and profits, damaging from $104 worth of Oregon tart cherries per hectare and up to $7,267 worth of Washington Honey Crisp apples in 2013.

But birds can be part of the solution, too, as some farmers have known for decades. Forty years ago, the son of one Cherry Bay Orchards worker, to complete an Eagle Scout project, built and installed kestrel nest boxes on the Orchards' property. They were immediately occupied by kestrels and continue to have a 75-80% occupancy rate. The kestrels do an excellent job of reducing bird and rodent pests, which are particularly damaging to seedling trees. Another cherry grower, Jim Nugent, installed kestral thirty years ago. "From the time I started getting nesting kestrels, I sure observed a decline in problems," he says.

Kestrel nest boxes have several advantages over other means of pest control. The birds are feeding young families, so they are self-starters and highly motivated. They kill and eat some pests and scare others away; the scare effect does not wear off, as it does with propane cannons, balloons, and hawk silhouettes. And they are popular with the public and extremely cost-effective. Every dollar spent on a nest box saves between $84 and $375 worth of fruit and avoided costs. Nest boxes on farms are good for the kestrels, too. Their numbers are increasing in cherry-growing counties that use them, while kestrels have declined fifty percent continent-wide in the last fifty years.

A kestrel finds a rodent to feed on. (www.gardenbirdwatching.com)

One size does not fit all when using wild birds for pest control, however. Farther south, starlings tend to take over the nest boxes Kestrel chicks fledge and leave the nest before blueberries ripen, so there is no protective effect for blueberry growers.

But other birds can also be helpful. Lured by nest boxes, barn owls have been partnering with farmers all over the world to kill rats and other harmful rodents, including in wine country in Israel and California . Nest camera studies show that a single owl family will eat around three thousand gophers, mice, and voles. Barn owls prefer nesting and hunting in natural areas over farmland, but in nest boxes on the wilder margins of farms, GPS tracking shows that they spend one third of their time hunting cultivated land.

All of which pushes the conclusion that science has been showing for several years now. It is beneficial to wildlife and to farms to keep some areas unculti-vated. A little brush and woodland along the edge of the field, combined with a cultivator strip of native flowering plants and a beetle bank of tall, uncut grasses, creates a home for beneficial insects and for birds, hunting ground for owls, cover for insect predators, and resting places for migratory birds and butterflies.

Songbirds can also play a crucial role in reducing the numbers of insect pests. 'Our' warblers, the ones that summer in the Northeast, like black-throated blue warblers and American redstarts, winter in Central America, where they consume coffee berry borer in shade-grown coffee plantations, benefiting growers to the tune of $126 per acre in saved crops and avoided pesticide costs. The right cup of joe in the winter can help provide habitat for our birds, so they can return in the summer to delight us.

Bluebirds are easily attracted by nesting boxes. Providing boxes can quadruple the number of nesting birds in an area, and bluebirds eat two to four times as many bugs on farms with manmade nest boxes as they do on farms without them.

The message from nature is the same no matte where you look. Biodiversity isn't some nice-to-have frill. It's how the whole thing works. Not surprisingly, farmers who understand that and find a way to work with nature reap benefits in profit and reduced work.

Jessie Haas has lived for 36 years in an off-grid cabin in Westminster West, VT. She is the author of 40 books for children and adults, most recently The Hungry Place. ♻

Multifamily Community EV Charging – Cont'd from p. 7

take advantage of programs such as the New York's EV Make Ready program that helps fund such upgrades.

Some specific examples from Ecovillage Ithaca

Ecovillage at Ithaca has been making use of these strategies since 2017, and is well along the way to their goal of one charger per household. They currently have around 25 EVs for their 100 households, with more added monthly.

Here are some implementation details that may be of interest.

One question is where to mount outlets and chargers within a carport? They typically mount the chargers up high above the vehicles, because that simplifies wiring and protects equipment from damage. Then they attach the charging cable to the ceiling and drop it down conveniently wherever the charge port happens to be located on that specific vehicle.

Generally, chargers are purchased directly by residents and the maintenance crew mounts and configures them. That saves capital and leaves the residents responsible for any service or replacement costs.

For charging outside of roofed structures, they use a simple fence-like structure to mount charging outlets. This makes it easy to wire multiple outlets by running along the cross beams, and it is easy to expand. They have benefited greatly from incentive programs to help fund this build out. Be sure to check for any local or federal incentives to support your efforts.

EV's are coming fast, so access to charging will become a key factor in attracting residents. Now is the time to start getting ready so you can do your part to move this transition forward.

Carport at Ecovillage at Ithaca, NY; center:Daisy-chained wiring; bottom: Outdoor charging structure

Jeff Gilmore is an engineer consulting on computer technology and renewable energy projects under the name Localforce.io. He and his family live at Ecovillage at Ithaca in Ithaca, NY. ♻

Behind the Blue Bin – What Is Recycled?

Adam Minter

Local governments began distributing recycling bins in the 1970s. Those bins were largely reserved for the flood of daily headlines, as newspapers were attractive raw material for paper mills.

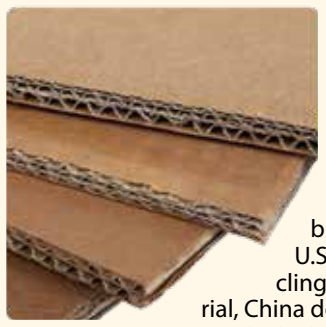
By the 1980s, many cities had also signed contracts with materials recovery facilities (MRFs), which use sophisticated tools to separate different types of metal, glass, paper, and plastic that they then sell. People may recycle out of idealism, but it's all business at the end.

MRFs have made modern blue-bin recycling possible, but they have also created an aura of mystery around what is and isn't happening. Reliable data has never been collected on how much is actually recycled from blue bins nationwide. What happens to those objects you optimistically recycle depends on many factors. Here are a few possibilities.

Recyclables on the conveyor belt with a worker sorting them at the Williston, VT Materials Recovery Facility. (Cassandra Hemenway)

• The humble aluminum can is the most recycled item, largely because it's easy to sort and melt into new versions of itself. Nearly half of all cans are recycled.

• In theory, polypropylene (PP) is recyclable, but there are only a few facilities in the United States that accept it—and most MRFs aren't anywhere near one. For now, an MRF worker will likely place a yogurt container in a landfill- or incinerator-bound trash bin, especially if it has foil or a different kind of plastic attached.



In 2017, after decades as the biggest buyer of U.S. recycling material, China decided to restrict its import. The price of discarded cardboard fell by 84% making recycling economically impossible for some municipalities. Today, new and refurbished paper mills in the U.S. are cranking out cardboard boxes for the pandemic-fueled boom in online sales. Cardboard trades at $171 per ton (up from $60 in 2019).

• There's no shortage of manufacturers who want to use recycled glass in their products. Unfortunately, not enough recyclers have installed the technology to sort clear from colored glass, and thus large volumes end up as waste.

• High-density polyethylene (HDPE) was once virtually unrecyclable because it was so cheap to make. Now that manufacturers use more recycled material in packaging, the price for HDPE has skyrocketed in just a year from $.04 to about $.60 per pound.

Adobe stock/6850073

• Known as "mixed paper" in the recycling world, junk mail was once exported almost exclusively to China. Now it goes to India and Southeast Asia as well as domestic paper mills, which pulp it to feed the cardboard boom.

• About a third of polyethylene terephthalate (PET) containers, one of the most easily recyclable forms of plastic, are washed, shredded, and melted down. Some companies glue labels made of a different kind of plastic to PET containers—an innovation that renders some unrecyclable unless the label comes off.

Adam Minter has been writing about waste and recycling since 2000. He is a columnist at Bloomberg Opinion, and the author of Secondhand: Travels in the New Global Garage Sale and Junkyard Planet: Travels in the Billion Dollar Trash Trade.

This article was originally published in the winter Sierra magazine and online on December 22, 2021 ♻

UVM Electric Lawn Mower Pilot Program

Niels Arentzen and Peggy O'Neill-Vivanco

When University of Vermont (UVM) Business student Niels Arentzen was in high school, he operated a lawn care business, and explored the possibility of starting a commercial electric mowing company. His research into the technology highlighted the emissions and fuel savings, as well as noise reduction, but the upfront costs were too high for his small-scale operation. He didn't give up on the idea of electrified lawn care equipment, and once on UVM's campus, he realized that UVM could make the transition to electric mowing. The University needs to have the grounds cut sharp, in an efficient and timely manner, while classes are going on, and students, staff and faculty are living, learning, working and playing in and around the grounds. Complaints about the noise and emissions from lawn equipment often mean that the grounds-keeping crew must adjust its schedules around building occupancy, exam schedules and quiet hours around residential buildings. This was the perfect setting to pilot electric lawn equipment.

In January 2020, Niels reached out to Peggy O'Neill-Vivanco, the Coordinator for VT Clean Cities Coalition at UVM's Transportation Research Center. Together they wrote a proposal to UVM's Clean Energy Fund (now called the Sustainable Campus Fund), to pilot a 60"zero-turn (ZTR) electric lawn mower. To support the pilot proposal, Niels got over 500 signatures from students and faculty on a petition for the need to switch from fossil fuel-powered lawn equipment to electrical. Many signed because of the noise levels and pollution of conventional equipment, which can disrupt learning. The pilot supported the Clean Energy Fund's goals and the UVM's Climate Action Plan by working to reduce fossil fuel use on campus.

UVM pilots an e-mower which offers affordable, no emissions, and quiet lawncare. (Matt Power)

Replacing fossil fuel-powered mowers with e-mowers that use 100% renewably-sourced electricity will help UVM reach its commitments to climate neutrality by 2025.

According to an EPA study, a 24 HP commercial ZTR mower, similar to the ones used by UVM, running for an hour is equal to 88 cars driving at 55 MPH or 4,840 vehicle miles traveled in terms of emissions. In contrast, operating one 60" commercial electric mower for 400 hours annually produces zero emissions, versus the nearly 8,000 lbs. of CO2 produced by a comparable conventional commercial mower.

The goal of the project was to evaluate the efficacy of an e-mower for UVM's lawn care needs. While the pandemic delayed the pilot's rollout, the mower was finally purchased and put into use at UVM during late summer 2021. It was in use for 150 hours of mowing during the 2021 season and resulted in 7582 kWh of energy used; saved 225 gallons of gasoline and over $731 on fuel; reduced noise pollution from 100 to 85 decibels; and prevented over 2,000 lbs. of CO2 emissions. (The sound-pressure scale in decibels is logarithmic, making this sound reduction very significant.) University students, employees, and visitors reap the health benefits of breathing less-polluted air during the mowing months of the summer and fall. Additionally, students, faculty, and staff were spared having to compete with the sounds of noisy conventional mowers outside their classrooms and offices.

This success, and the positive feedback from the Grounds crew on the efficiency and operating of the electric lawn mower led Matt Walker, Grounds Manager at the Physical Plant Department (PPD), to propose additional funding for electric chore tools – push mowers, trimmers and leaf blowers – for campus crews to use. Building off the electric lawn mower pilot, and with support from VCCC, Matt's 2022 proposal to the Sustainable Campus Fund seeks to support the purchase of electric lawn tools to help PPD decarbonize a significant portion of its landscaping tools. In addition to reducing carbon emissions, the electric leaf blowers will comply with the new City of Burlington noise ordinance and will not exceed the noise level of 65 decibels. Again, equipment electrification will have a direct and positive impact on campus climate by improving students' learning and health by reducing localized air pollution, noise pollution and greenhouse gas emissions around residential and academic buildings.

These projects highlight great collaboration between a UVM student and the Grounds Department. This isn't to say that there was a seamless and easy conversion by the crew to the e-mower, but support from the Grounds Department leadership made an easier path for the pilot to take place, and the crew to be part of an exciting electrification project.

Peggy O'Neill-Vivanco conducts program outreach and coordination at the Transportation Research Center at UVM. Peggy holds an MA from NYU. She is a year-round bike commuter, and advocate for safe bicycle and pedestrian infrastructure for all users.

Niels Arentzen studies Finance and Art at UVM and will graduate in May 2022. He can often be found in the lake or in the mountains. He looks forward to continuing his work with sustainability on the supply chain team at Beta Technologies and through impact investing at the Hula Fund. ♻