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Feature: Celebrate the Earth (pages 20-21)

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Clean Energy Investments

Can the Remarkable Run Continue?

Todd M. Walker and Craig R. Walker

What a year 2020 was for clean energy investments of virtually all kinds – from solar to wind, electric vehicles to batteries, green utilities to clean energy financiers. For example, the Invesco Solar Exchange Traded Fund (symbol TAN), was up 233.95% last year, versus 16.26% for the S&P 500.[1]

For the first time, clean energy investments not only had their best year ever, they were among the top investment sectors of any kind in 2020.[2] So, for both investors who caught this wave and those who may be thinking about getting in, the big question now is: will it continue or was it just a bubble?

The windy region in California between the San Jacinto and San Bernardino mountains is a perfect place for harvesting wind. Photo Erik Wilde/Wikipedia Commons.

As of this writing (March 1st) the answer is mixed. Clean energy investments continued to boom this year up to mid-February, then joined the rest of the market in a sharp reversal until they are now about breakeven with the beginning of the year, although still far above Jan 2020. So which way from here?

Six Reasons the Future Looks Bright

While past performance is no guarantee of future results, we believe that clean energy investments not only still have a very bright future but should also be an important component of most portfolios today, whether your objective is growth or current income (there are green investments designed for both). Here, briefly, are some big reasons why:

- **Vast potential for remaining growth.** The world has only just begun to make the switch to renewable energy. For example, while renewables (i.e., biomass, hydropower, geothermal, solar and wind) in the U.S. continued to expand their lead over coal and nuclear power in 2020, they still provided only 20.6% of the nation's

Cont'd on p.19

Going Electric on Two Wheels

Brett Yates

Harley-Davidson's All-electric LiveWire

John Lyon, the manager of Wilkins Harley-Davidson in Barre, VT, has ridden Harley-Davidson motorcycles since the age of 16. It's no surprise, given that his grandparents opened the dealership together in 1947 in his great-grandmother's garage, and it has remained in the family ever since, steadily selling "nostalgic" cruisers to long-time brand enthusiasts.

"Loyalists are a unique breed," Lyon observed. "They love Harley-Davidson's history, its heritage. Harley-Davidson produces motorcycles that are constantly a throwback to the past."

John Lyon, the manager of Wilkins Harley-Davidson in Barre, VT, shows off one of the LiveWires in his showroom. (Courtesy photo)

The Harley-Davidson LiveWire ($29,799), released in 2019, is a notable exception. A futuristic sportbike, it remains, so far, the only electric motorcycle in mainstream production by a major manufacturer. Lyon took to it immediately, and he now uses it for commuting as weather permits.

As the industry's first recognition of the green energy revolution by a legacy brand, the debut of the LiveWire marked a watershed for electric motorcycles, previously the domain of high-tech start-ups and custom builders. "We know there are states that are banning internal combustion engines in the future, so to be relevant in that time period, we have to start talking about this now," Lyon noted.

"Per mile, it's more exhilaration than any other machine I've ever ridden," he rhapsodized. "The torque curve is to the peak of any graph, meaning we've put it on a [dynamometer] and we have to have people hold it down on the dyno

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Higher Paying Jobs for Clean Energy

George Harvey

What a year it has been! It was just over a year ago that we went into an economic slump because of Covid-19. Many jobs were closed down to reduce levels of virus transmission, and we have had very high levels of unemployment. Fortunately, it looks like there is hope that the situation is improving and will continue to do so.

Employment numbers in the energy fields fell. This was especially true for coal miners, many of whom had to deal with both confined work spaces and a failing market. It was also especially true of the oil and gas industry, because people were not traveling much. It was true for clean technology as well, but not nearly as badly. With about 500,000 clean technology jobs lost, well over 350,000 were in areas of efficiency, such as insulation installers. And in some areas, such as wind technicians, the pandemic has had a relatively minor effect or none at all, as record capacity of solar photovoltaics (PVs) and wind turbines were installed.

There are jobs to be had in renewable energy. Interior Secretary Deb Haaland views a wind farm from the top of a wind turbine. Image by Deb Haaland, found at Wikimedia Commons www.bit.ly/3tqYdpT.

There are a number of forces at play for energy jobs, and we would do well to understand them. First off, the coal industry has been on a decline that was predictable over a hundred years ago, when the U.S. Navy stopped ordering coal-fired ships. The industry could be said to have peaked in 1923, when there were 863,000 coal miners in this country. In 2017, when Donald Trump was inaugurated after promising to restore coal jobs, there were fewer than 52,000 left. By the time he left office, the number had dropped to about 46,500.

Coal lost jobs to the oil and gas industry, particularly with fracking making prices low for gas. That, however, might not last. In fact, Morgan Stanley says that the oil industry will soon be obsolete. A recent article at CleanTechnica said, "In a recent survey of institutional investors, Morgan Stanley found that 17% of respondents think ICE [internal combustion engine] technology has zero or negative value today, and 60% said its value was only slightly positive" (www.bit.ly/3tgkdUg).

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IN THIS ISSUE

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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.

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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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Letter from the Editor

Our theme in our April/May edition of *GET* is *Celebrating the Earth***.** While every day and every edition of *Green Energy Times* is about the earth and the future of our planet, this is the time when the world comes together for the earth!

At this time actions are taken to clean the roadways, and other earth-related activities – but what else are we each doing on a daily basis for the earth – to slow the progress of a changing climate?

From simple things like picking up trash along the roads when we walk with or without our dogs all year long, to reducing your waste and keeping your trips to town to a minimum, resulting in lower transportation emissions, it all adds up.

The pandemic has forced many to work from home -- a gift for carbon emission levels. It has given us time to get out and enjoy the outdoors, perhaps on a bicycle or e-bike. Sales for bicycles surpassed most manufacturer and bike shop owners expections. Cross-country skiing saw another boom in sales and it got us outdoors to enjoy this beautiful planet we live on. Being a good steward of our earth is the best thing you can do.

You will find solutions to transportation in the pages of *GET* as well as renewable energy. Our energy grid is growing cleaner with every choice made to go solar – at home or for businesses. Solar costs are low today and lower your cost of everyday living, for the long haul. That payment replaces your current utility bill, with an end in sight to it if you own your solar. Will there ever be an end to your utility bill?

Another huge cost saving comes from making your home efficient. High levels of insulation and sealing air leaks will lower heating and cooling needs and costs. In turn, your use of fossil fuels will be less, as well as your carbon emission contribution. Learn more in our building and heating efficiency sections.

Back to the earth – we hope you think about the planet long past Earth Day. Learn why it is so important to act now in our Climate News section. The future of our children will be determined by our actions today.

We hope you learn from the information on our pages of this issue and every issue of *Green Energy Times* -- and take action in your own life every day.

Be well, wear your masks, get that vaccine and let's work together to keep each other safe – and let's each do more to care for and celebrate the earth.

Happy spring to all!
–Nancy Rae Mallery, publisher

Bhima Nitta Had a Dream correction

We have a correction for the January 2021 print edition of *Green Energy Times*, in the article on page 9, "Bhima Nitta Had a Dream!" Bhima Nitta's name was consistently misspelled in the article. It was corrected in the online edition. Bhima's last name is not 'Vitta', but is 'Nitta'.

I wish to comment on this error. It came about as a combination of two errors of mine, one of which was sad, and the other inexcusable. I had interviewed Bhima Nitta more than once and mentioned him in even more articles. He was highly regarded. I should not have misspelled his name. When the article was sent to Power Guru to be looked over for accuracy, it came back with the name corrected. Unfortunately, I managed to send the earlier draft to our proofreaders, who had no way to see that it was wrong. This error was entirely mine, and I hope no one holds it against *Green Energy Times* or anyone else connected with it.

– George Harvey

Addressing the Biggest Problems

Op-Ed (Letter to the Editor) from Ryan Yoder - Danby, VT

Some of the biggest problems facing Americans are collapsing ecosystems, climate change, and an exponential curve in the incidence of chronic disease. There are compelling arguments that any of these alone has the power to collapse our economy and civilization, and their convergence is a stark case study in what "existential crisis" means.

We started our farm in an attempt to take direct action to counter these terrifying crises. Over the ten years of our business, we have watched a new paradigm emerge that carries the promise of Health for humanity. This is the paradigm of "Regeneration" (also known as regenerative agriculture) which has the explicit goal of improving the underlying health of soil as the most effective means to regenerating the water and carbon cycles, heal our chronic disease epidemic, and revive the health of our economies, psyches, and spirits!

Essential to this movement is rebuilding the microbiome, in our bodies as well as the soil, by decreasing the toxicity which negatively impacts it. There is increasing evidence that the largest driver of our chronic disease trajectory (and therefore Covid deaths) is the toxic antibiotic glyphosate, which is used as an herbicide and for desiccating grain crops before harvest. There is ample evidence that Atrazine, another herbicide, is a major endocrine disruptor that has been shown to cause trans-sexuality in amphibians. Prohibiting these chemicals in food crops would seem to be a no-brainer if we care about health and the environment, but perhaps that is only the tip of the iceberg?

How about the hundreds of thousands of gallons of Roundup, used by homeowners and golf courses to kill dandelions and other weeds? Reframing our understanding of health and ecology using the regenerative paradigm would give us practical methods for addressing the crises at all levels, giving us innate guidance about how to turn lawn care into a healing practice rather than just another net CO2 emission vector.

Principles that increase soil carbon in fields include biodiversity, mob grazing livestock, eliminating chemical use, and reducing tillage. Why not apply these principles to lawn care? Build biodiversity in lawns by NOT killing weeds, reduce mowing to an occasional mimicry of grazing herds of animals on the savannah, maybe get some sheep. The power to change the future resides in how we understand the present. Let's understand it regeneratively. ♻

Concentration of CO2 in the Atmosphere

416.46
parts per million (ppm)
March 30, 2021

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RENEWABLES RULE AND SOLAR SHINES BRIGHTEST

George Harvey

In its last issue, *Green Energy Times* had an article, "EIA Projects Huge Decline for Natural Gas Generation" (www.bit.ly/EIA-gas-decline). With new information from the Federal Energy Regulatory Commission (FERC), we can say more about that and the implications for renewable energy.

A field of solar arrays. (American Public Power Association, Unsplash, www.bit.ly/39tXZGP)

It is now pretty clear that we have hit a turning point. Data from FERC for the year 2020 was released in February, and when we compare capacity installations for 2020 with those of 2019, we see a remarkable change. The monthly data can be viewed by going to www.bit.ly/FERC-staff-reports and clicking on Energy Infrastructure.

Additions of solar and wind capacity together were up 40% in 2020, compared to 2019. In 2020, there were 22,169 megawatts (MW) of solar and wind capacity installed, compared to 15,869 MW of new capacity in 2019.

Additions of natural gas capacity were down 38.5% in 2020 from 2019. They fell from 10,185 MW in 2019 to 6,159 MW in 2020.

In absolute terms, natural gas capacity grew in 2020 but not as fast as the capacity of the grid as a whole. The difference was great enough that the percentage of our electricity that was generated from natural gas actually fell. In 2019, natural gas provided 44.67% of our electricity, but in 2020, it provided 44.33%.

The fall of coal is continuing. In 2019, it was 20.89% of our generating capacity, and for 2020, that had fallen to 19.65%. This may not seem like much of a decline, given the various news pieces we have seen about coal-burning power plants falling out of use, but we should note that the decline in capacity is happening at a time when coal's capacity factor is also declining. And in fact, it has fallen to below 50%. In plain language, this means that we have fewer coal-burning power plants, and the ones we do have are being used less than they had been.

When we combine coal and natural gas, we find that the total generating capacity of the two has fallen about 1%. With lower capacity factors, electricity generated by these two sources fell more than that. Oil-fired capacity declined last year marginally. The same is true for nuclear power. Nothing in fossil fuels and nuclear power has a growing market share, and the only one growing in absolute terms, natural gas, is doing so in rapidly declining amounts.

The decline of natural gas is also the subject of an Energy Information Administration (EIA) report in January, which sees 6,600 MW of new natural gas capacity added in 2021 (www.bit.ly/EIA-forecast-2021). This was reported in *G.E.T.*, as we noted above. However, the latest FERC report, cited above, anticipates 9,092 MW retired over the next three years, so it may be that the net additions of natural gas this year would be about 3,600 MW.

While the FERC report said 8,543 MW of new solar capacity was added in 2020, the report from the EIA in January anticipates 15,400 MW of solar added in 2021. These are figures we should take with some caution. The federal government has only very recently started trying to account for solar installations of less than 1 MW. Since roughly 40% of solar capacity installed is in systems less than 1 MW, the FERC figure could actually represent only 60% of the amount actually installed. If that is the case, then the amount actually installed in 2020 could have been over 14,000 MW. And if that is the case, then the EIA expects growth of about 10%. That would also mean, however, that solar photovoltaics are much more important than most people understand.

In any event, the report from the EIA says it expects that 39% of all new capacity in 2021 will be solar, and 31% will be wind. There would be no installations of coal-power plants, and natural gas would account for 16% of the share. A small amount of nuclear power is expected to provide 3% of the new capacity.

As we might all know, solar power is intermittent and wind power is variable. They both have the advantage that they can be curtailed, which thermal power plants cannot. In effect, they can be shut off to prevent too much power from going onto the grid. While batteries offer a solution to supplying energy from the sun and wind when neither is generating, they also offer a solution to the problem of curtailment. The result is that battery use is also growing, and the EIA expects 11% of new capacity will be batteries.

With low prices for renewable electricity, and with those prices heading lower, the fossil fuels industries can only decline. And we may have turned that corner already, in the last two years. ♻

VIDEO REVIEW

"The Dirty Truth about Combustion Engine Vehicles"

Created by Mark Linthicum, 14 minutes, https://www.youtube.com/watch?v=mk-LnUYEXuM

Video review by Victoria Ines

It is common knowledge that Tesla cars are incredibly expensive. Personally, I have always wondered why they are so costly and whether they are even worth the money. Of course, I knew that electric vehicles (EVs) were more environmentally friendly than petrol cars, but I have never fully considered the benefits of an EV. However, after watching an animation on the difference between EVs and petrol cars I was able to appreciate the differences, and I now realize why electric cars are a much better choice for environmentally conscious consumers.

The animation "The Dirty Truth about Combustion Engine Vehicles" discusses the misconception that the process to power an EV pollutes the same amount as a petrol car. Image: YouTube.

The animation "The Dirty Truth about Combustion Engine Vehicles" mainly aims to refute the misconception that the process to power an EV pollutes the same amount as a petrol car. Robert Llewellyn, the host of the YouTube channel Fully Charged, narrated an animation created by Mark Linthicum. With the use of interesting and well-designed graphics, as well as effective facts, Linthicum was able to make a solid case as to why it is unfounded to argue that EVs and petrol cars cause comparable pollution.

To make his point, Linthicum compared the electricity usage of a single pump jack (used to pump oil) to driving a Tesla Model 3. According to Linthicum, a single month of pumping oil is equivalent to either 9,960 kilowatt-hours or driving a Tesla for 34,860 miles. That means that the choice would be between a mere month of pumping oil (unprocessed and unready to power a conventional car) or 3 entire years of driving a Tesla. Consider then the fact that there are a total of 435,000 oil wells that use pump jacks in the United States. There are underwater offshore oil rigs as well, which use 20 to 30 metric tons of diesel, the equivalent of 300,000 kilowatt-hours. Not only that, but there are several subsequent steps to converting oil into usable energy. For instance, the transportation of oil is also a major cause of pollution. The ships that transport the oil are such heavy polluters that some countries do not even allow them to be piloted near their coasts. Similarly, oil refineries are the largest source of pollution where they operate.

As Linthicum continues to make his arguments, it seems more and more ridiculous to use billions of kilowatt-hours to generate usable oil, rather than simply use that electricity to directly power electric vehicles. This is particularly true because after the oil is converted into usable material, over 70% of energy is wasted when fuel is used in combustion engines. However, some still argue that the negative environmental consequences of lithium mining are much too great. Linthicum makes it clear that this argument is not valid. For instance, Australia produces the largest amount of lithium in the world. Even though Australia refines 0.25% of the world's oil, but mines 50% of the world's lithium, its oil refineries are still much more damaging in terms of pollution.

I am definitely not saying that all readers should immediately buy a Tesla, but as electric cars become more mainstream, most major car manufacturers are designing and building their own electric cars. It has become increasingly affordable to buy an electric car, and many people are incentivized by the idea of saving money on gas. As a high school junior, I am not an expert on cars -- I don't yet have a car and have not considered buying one. However, after watching this video, it has become clear to me that electric cars are the future of driving and using them can be an important step toward a healthier planet.

Victoria Ines is a junior at Shenendehowa High School in Clifton Park, NY. She is passionate about working to protect both the environment and endangered species. After high school, she would like to attend a 4-year college to study engineering or biology. ♻

GOING ELECTRIC ON TWO WHEELS

Cont'd from p.1

Harley Davidson Livewire

because it's too aggressive of a machine to be on a measuring tool that usually measures internal combustion engines." Because electric motorcycles don't have a clutch ("Just twist the throttle and go," Lyon explained), they sometimes interest new riders hoping to avoid learning how to shift gears.

While the LiveWire seeks to tap into a younger market, Lyon expects that the company one day will begin to manufacture electric touring motorcycles for its conventional clientele, too. "I'm sure they're being discussed right now," he conjectured.

"Most of the traditionalists have been OK with the idea" of going electric, Lyon said, "but they just want it to go farther than it currently goes on one charge." The LiveWire offers 146 miles of city range and 95 miles of combined city and highway range, with a charging speed of 40 minutes from empty to 80% (or one hour for a full battery) – just long enough for a quick lunch.

Other Electric Motorcycles

Riders with "range anxiety" may instead favor Energica Motor Company, an Italian all-electric manufacturer whose three bikes – the Eva EsseEsse9 ($21,600), the Eva Ribelle ($22,400), and the Ego ($24,110) – each boast 249 miles of city range and 143 miles of combined city/highway range.

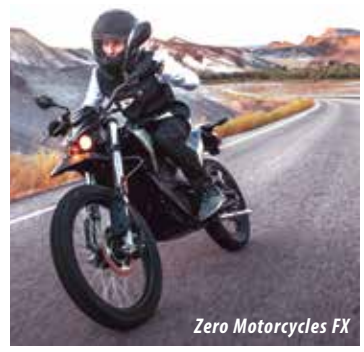
In early 2021, Rob Swartz opened Energica of New England in Gardner, MA, 10 miles south of the New Hampshire border. Committed to the single brand, he doesn't sell any gas-powered motorcycles.

Founded in 2014, Energica has gained attention as the exclusive motorcycle supplier of the FIM MotoE World Cup, in which professional road racers, between May and September this year, will compete on seven circuits across Europe, providing an environmentally friendly alternative to the FIM's top division, MotoGP. In Swartz's view of Energica, "the engineering involved and the technology involved is far superior to anything out there."

Energica's most powerful models accelerate from zero to 60 mph in 2.6 seconds, using 145-horsepower engines, compared to the LiveWire's 105. And for customers willing to accept a smaller battery, the price of a new Energica motorcycle can dip as low as $17,600.

Prices in the electric motorcycle market, range from $2,495 for the CSC City Slicker (top speed: 47 mph) to $117,000 for the plush Arc Vector (shipped from England). There are plenty of limited-production and made-to-order options, and giants like Honda and Yamaha have signaled intentions to enter the market soon. But for the customer who wants to drive to a dealership today and come home with an electric motorcycle, the choices are Harley-Davidson, Energica, and Zero Motorcycles, which has the most extensive electric line-up of the three.

Jordi Torres rides the Energica Ego Corsa in the MotoE World Cup



Zero Motorcycles FX

Stretching from the FX ($8,995) to the SR/S ($19,995) and topping out at 223 miles of city range, Zero manufactures ten electric motorcycles, targeting commuters, tourers, and off-road enthusiasts. Cyclewise in New Haven, VT, hosts the brand's only New England showroom.

"The specific buyer for Zero knows what they're looking for. It's not so much a conversion thing," commented Cyclewise sales manager Andy Duggento.

According to Duggento, Cyclewise sells eight to 15 electric motorcycles from Zero in an average year, compared to 50 or 60 gas-powered Ducatis in the same period. But he expects Zero's numbers to grow, "It's the future, and we were on board early with that."

His favorite model is the FX, which he called a "small, lightweight street bike." Electric motorcycles' instantaneous acceleration makes them, in his words, "very thrilling."

"It's probably the most unique riding experience you'll ever have on a motorcycle," he went on. "The biggest thing I get from people is the noise. 'Loud pipes save lives.' But there's something to be said about you being in tune with everything around you."

Tax Credits for Electric Motorcycles

As with electric cars, the federal government extends a tax credit (up to $2,500) to buyers of electric motorcycles. State-level incentives are limited to California, Oregon, Pennsylvania, and Arizona, but many electric utilities offer rebates, including $1,000 from the New Hampshire Electric Co-op. And between March 1 and June 20, 2021, Green Mountain Power will rebate electric motorcycle purchases by $500.

This new rebate joins Green Mountain Power's customer rebate for e-bikes, which takes the form of a $200 discount at participating bike shops in Vermont, such as Green Mountain Bikes in Rochester. According to store owner Doon Hinderyckx, who has sold bicycles for more than 30 years, e-bikes "are more fun, period." While electric motorcycles continue to aim for a foothold in a gasoline-dominated industry, e-bike sales have exploded over the past year, with millions of purchases in 2020. EZ Bikes and Scooters in Exeter, NH, has stocked them since 2009.

Electric Bicycles and Scooters

Magnum Metro+

"People are looking to get outdoors because of Covid-19, they've been stuck inside for so long," said EZ Bikes and Scooters co-owner Teresa Hemenway.

An e-bike is like a regular bicycle, but it has a battery-powered motor (250 to 750 watts) that supplies additional propulsion when the rider pedals. Some varieties allow the rider to activate the motor with a throttle.

According to Hemenway, most of her e-bike customers are over the age of 45. "They've been accustomed to riding a bike but maybe haven't for a while or aren't as physically strong as they once were. The electric bike allows them to bike the way they used to."

Hemenway also mentioned a customer who, after suffering a bout of polio in his youth, thought he'd never ride a bike again. He now "puts thousands of miles" on his e-bike every year.

Lately, automobile companies like Jeep and Porsche have begun to produce e-bikes, alongside traditional bicycle manufacturers like Trek and Cannondale and a host of newer firms. EZ Bikes & Scooters carries a few e-bikes by Admotor and Scootstar, but the Magnum line (starting at $1,399) dominates its showroom with "probably 20 different styles," in Hemenway's estimation.

Hemenway cited the brand's road bikes, mountain bikes, and folding bikes. "They make a bike for every person, every body size, and also every application."

In addition, the shop sells electric motor scooters by Beijing-based NIU, which Hemenway called "one of the fastest-growing electric scooter companies in the world." According to technician Steve Phillips, the primary advantage of electric scooters over their gas-powered counterparts is that they don't require much care, which can help owners recoup their higher upfront cost.

"Maintenance is going to be close to nothing," Phillips noted. "Compare that to a gas scooter – you're having to do oil changes, periodically replacing belts, cleaning carburetors, making sure there's good fuel in the scooter, because small gas engines are a little more temperamental than a car or a pickup truck."

The downside on the electric front, unsurprisingly, is range: only 40 miles on the N Sport model ($2,899), which makes it "very suited toward urban areas." But on the New Hampshire Seacoast, riders tend to use scooters for long pleasure journeys rather than commutes, leaving the electric versions to early "adopters of new technology," as Phillips put it.

The most popular models tend to be "50cc-compliant, so they're vehicles that you need a regular driver's license to operate, but you don't need a motorcycle endorsement," he noted.

NIU scooters are made for seated riders, but EZ Bikes & Scooters also sells an electric kick scooter, Magnum's iMax S1+, for standing riders. With a range of 15 to 20 miles, this small, portable vehicle appeals mostly to "younger people, 16 to 24, who are living in downtown Portsmouth," in Phillips's experience.

NIU scooters

No federal tax credit exists for either variety of electric scooter, except for models that reach speeds above 45 mph, which qualify for the e-motorcycle incentive. In February, Democrats in the U.S. House of Representatives introduced a bill whereby the IRS would refund 30% of the cost of a new e-bike, but it has not yet come to a floor vote.

Brett Yates is a contributing writer for Green Energy Times. *He lives in Mendon, VT.* ♻

SMART COMMUTING IN NH & VT

Transportation emissions are among the worst offenders that add to the rising CO2 levels in our atmosphere. In recent months we have learned that our efforts have begun to reduce the detrimental air quality counts (NHDES), but as you may have learned from numerous other reports such as the International Panel on Climate Change (IPCC), http://climatechange2013.org/, global warming is still advancing faster than expected.

How do we get our emissions down now? By making new commuting choices!

Lots of choices. Smart Commuting is all about knowing your options and planning ahead. There are many choices to get around in New Hampshire and Vermont, The first place to start in Vermont is "Go Vermont" for statewide choices to travel more efficiently. Whether getting around town, commuting to work or school, or planning a day trip, share the driving or ride with someone else to help save our planet and to save approx. $2,000 annually. The statewide VT site also lists services for commuters, tourist, and shoppers.

In New Hampshire you'll find a similar site at "NH Rideshare" where you can find carpools, transit routes and schedules, bike and walk trails and links to statewide transportation information.

When carpooling, remember to use the local Park n Ride lots to meet your connections. Start your trip planning at connectingcommuters.org or nh.gov/dot/programs/rideshare/ for statewide choices.

IN NEW HAMPSHIRE

UPPER VALLEY RIDESHARE (UVRS) - Carpool matching, benefits and support for commuters in/out of Upper Valley. 802-295-1824 x208. **uppervalleyrideshare.com**.

ADVANCE TRANSIT (AT) – Free weekday bus for Lebanon, Hanover, Enfield, Canaan, NH, and Norwich and Hartford, VT. Dartmouth and DHMC Shuttles. ADA & Travel Training Services. 802-295-1824. **advancetransit.com**

CARROLL COUNTY TRANSIT - Services and connections to Belknap County. 888-997-2020 **tccap.org/nct.htm**

CITY EXPRESS - Serves Keene. 603-352-8494 **hcsservices.org/services/transportation/cityExpress.php**

SCS TRANSPORTATION - Services for Sullivan County.. 603-542-9609. **SCSHELPS.ORG**

CONCORD AREA TRANSIT (CAT) - Serves Concord 603-225-1989 **concordareatransit.org**

COMMUNITY VOLUNTEER TRANSPORTATION COMPANY (CVTC) - serving 34 towns in the Monadnock Region, providing "no fee" transportation for people with limiting circumstances. 877-428-2882 x5. **CVTC-nh.org**

COOPERATIVE ALLIANCE FOR REGIONAL TRANSPORTATION (CART) - Serving the Chester, Derry, Hampstead, Londonderry, Salem and Windham, limited service to Plaistow. 603-434-3569 **cart-rides.org**

DARTMOUTH COACH - Services to Boston, Logan Airport and NYC 800-637-0123 **dartmouthcoach.com**

MANCHESTER TRANSIT AUTHORITY (MTA) - Manchester, with links to Nashua and Concord. 603-623-8801 **mtabus.org/services/local-buses**

MID-STATE REGIONAL RIDE RESOURCE DIRECTORY - Services elknap-Merrimack Counties, excluding Hooksett and the towns of Deering, Hillsborough and Windsor of Hillsborough County. 603.225.3295 x1201. **midstatercc.org**

NASHUA TRANSIT SYSTEM (NTS) - Buses and trolleys with bike racks. 603-888-0100 **RideBigBlue.com**

NH RIDESHARE – Your Source for Transportation Alternatives. **nh.gov/dot/programs/rideshare/**

IN VERMONT

UPPER VALLEY TRANSPORTATION MANAGEMENT ASSOCIATION (Vital Communities) - Works with UV employers and communities to promote and improve commuting options. 802-291-9100 **vitalcommunities.org/transport/index.htm**

VERMONT PUBLIC TRANSPORTATION PUBLIC TRANSIT - Lists transit, ferries and more at **aot.state.vt.us/PublicTransit/providers.htm**

AMTRAK - Long distance train service. Discounts for AAA members and student advantage card. (800) 872-7245 **amtrak.com**

CHITTENDEN COUNTY TRANSPORTATION AUTHORITY - Burlington bus service with links to Montpelier, Middlebury and commuter route to Milton. **cctaride.org**

CONNECTICUT RIVER TRANSIT - Services in Bellows Falls and Springfield. **crtransit.org**

GO VERMONT - Offers carpool matching and commuter connections in VT 800-685-7433 **connectingcommuters.org**

GREEN MOUNTAIN RAILROAD - Day trips from White River, Champlain Valley, Bellows Falls and Rutland. **rails-vt.com**

GREEN MOUNTAIN TRANSIT AGENCY - Local service in Barre, Montpelier, Grand Isle, Stowe and Lamoille. 802-223-7287 **gmtaride.org**

GREY HOUND/VERMONT TRANSIT - Long distance bus services. 1-800-231-2222 **greyhound.com**/

LAKE CHAMPLAIN FERRIES - Transport between New York and Vermont via Lake Champlain. 802-864-9804 **ferries.com**

MARBLE VALLEY REGIONAL TRANSIT- For Rutland, Killington, rural Manchester, Poultney and Rutland to Bellows Falls. City routes Free on Saturday. 802-773-3244 **thebus.com**/

RURAL COMMUNITY TRANSPORTATION (RCT) - Buses, vans, and volunteer drivers. Routes via The Jay-Lyn, The Highlander (Newport - Derby Line); The US RT2 Commuter (St. J. to Montpelier) and Free routes to rural areas. 802-748-8170 **riderct.org**

STAGE COACH - Commuter buses from Randolph and Fairlee to Dartmouth, Local village buses. 800-427-3553 **stagecoach-rides.org**

The Latest News on Electric Pickup Trucks: 2021!

George Harvey

Rivian R1T. (Photo © 2020 Andi Hedrick, courtesy of Rivian)

Tesla is a success story that has so far been almost unbelievable. Tesla's first car was first produced in 2009. In December of 2020, CNBC ran a story explaining that the market value of Tesla was greater than the market values of Fiat Chrysler, Ford, GM, Honda, Hyundai, Nissan, Peugeot, Toyota, and Volkswagen, put together (www.bit.ly/CNBC-Tesla-value).

The market value of a company really is only a measure of how people investing money feel about the future of the company. That said, however, it is clear investors see a good future for Tesla and are questioning the value of other auto makers.

Many Americans, unaware about changes in the broader world, might see electric vehicles as a fad centered on Tesla. We don't see electric buses, because there are so few here. Reporting in November 2020, GlobalNewswire said there were only 650 in the entire country (www.bit.ly/GNW-650-buses). But we found that the city of Bogotá, Colombia placed two orders for electric buses in January, for a total of 1,472 of them. The U.S.A. had a total of 650. Bogotá had more than double that on order (www.bit.ly/CT-BYD-Bogota).

There are two reasons Chinese electric buses sell so well. One is that the buses may cost 50% more than diesel buses, but they cost only 20% as much to run, and the difference is made up in just a few years. The other reason is that China does not have any competition. The electric bus market took off in 2016 and has grown at an alarming rate for four years, while we weren't looking.

Leaders of the automotive industry might have spent 2020 awakening to the fact investors valued their companies less than they did a newcomer with innovative ideas. They might have noticed that as sales slumped in 2020 because of Covid-19, sales of electric vehicles were increasing from 2019. We might wonder how they handled articles like one in EV Annex that said 60% of institutional investors said the value of internal combustion technology was "only slightly positive," and 17% said it had negative value (www.bit.ly/EVA-ICE-value).

GMC Hummer EV. (GMC)

Audi recently answered that question, as an article in electrive.com reported. Audi CEO Markus Duesmann explained in an interview in Frankfurter Allgemeine Zeitung that Audi has stopped development of internal combustion engines (www.bit.ly/ET-Audi-abandons-ICE).

This brings us to the most American of all vehicles, the pickup truck. The American legacy auto makers have taken no more interest in the electric pickup truck market than they have in electric buses. The same applies to people buying pickup trucks. Heavy duty vehicles for work and on the farm and smaller pickups for homeowners have been what these customers needed, and the customer is always right, right?

Electric pickup trucks are on the way.

Actually, if you count hybrids as electric, Ford already has one, the hybrid F-150. In fact, this truck was a hero during the big Texas power outage. Many of these trucks have built-in generators that can keep their shallow-discharge batteries from being damaged when the truck is being used for backup power. When it became known that some were being used to power houses, Ford offered dealers incentives to put F-150s with generators into their loan fleets and use them to help out in the crisis (www.bit.ly/Ford-saves-the-day).

The F-150 is actually a good place to start talking about electric pickups. A very recent update from insidevs.com tells us a lot about the all-electric F-150. It says, "Ford has just announced that the F-150 electric pickup truck will be the most powerful F-150 ever, and that it will feature a giant frunk (front-end trunk), dual motors and be the most capable Ford truck to date." And its most recent delivery time is for the first quarter of 2022, less than a year off. This is the same vehicle that famously towed a million pounds of loaded freight cars (www.bit.ly/IEV-F-150).

Pure electric pickups are on the way, also, and soon. Collating information from insidevs (www.bit.ly/IEV-pickups) and EVBite (www.bit.ly/EVB-pickups), we were able to find the following pickup trucks expected to be released in 2021:

The Rivian R1T is expected to be the first electric pickup truck actually delivered. Its starting price is $67,000. It will have a range of at least 250 miles and will have 754 horsepower (hp) motors. It is said evbite not really to be a work vehicle (www.bit.ly/GET-Rivian-pickup).

The Tesla Cybertruck is due out later this year. It is actually the lowest-cost electric pickup truck listed, at a

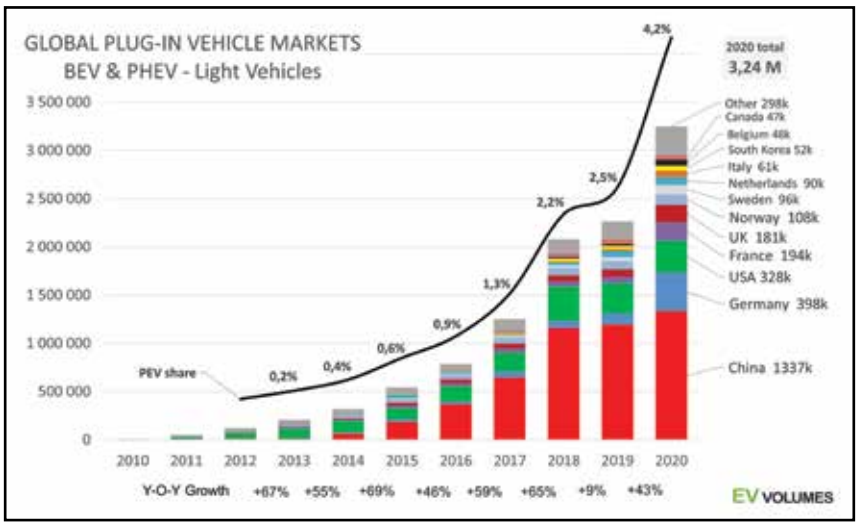
Cont'd on p.6

Economic Impact of Electric Vehicles for NH

Randy Bryan

One topic I did not spend enough time talking about at the New Hampshire Innovation Conference (see p. 7 for more information) is how electric vehicles (EVs) can help New Hampshire's economy. This economic view of clean technology is critical to reaching a broader audience and understanding. I offer my analysis of EV benefits to New Hampshire.

I'll be brief: Nevada recently did a study and identified over $20B in benefits over ten years by going to all EVs.



For my NH analysis, I'll assume the cost of EVs reaches parity with combustion vehicles by 2023+, and EVs' costs will continue to decrease (volume production and battery cost reductions) versus combustion vehicles, creating purchase savings versus combustion vehicles in the long run. The proposed Federal tax credit of $7000 may improve the purchase savings to NH owners in the short run.

In 2018, there were 714,000 Light Duty Vehicles (LDVs) in NH. Of that, about 2000 were plugins.

For the end of 2020, we'll assume there are about 700,000 LDVs in NH, including 4200 plugin cars. Average vehicle life span is about 11 years, so 1/11 the cars are replaced each year.

Transportation is now the largest polluter in NH, and the state has no policy to control this. This article will inform how plugin electric vehicles (PEVs) are good for NH residents and its economy in a variety of ways. Ergo, faster PEV adoption is better for NH.

Health Savings: NH's air quality in the highly populated areas can be poor, resulting in more premature deaths, higher healthcare costs and insurance, and lower work place productivity, to say nothing about our families' personal health. Transportation is now the largest polluter in the State. EVs don't pollute (Zero Emissions Vehicles, ZEVs). 2018 NH health cost from transportation pollution is estimated to be about $267M, and five to ten premature deaths per year (proportional extrapolation from other State's studies). We'll assume this is unchanged, though Covid 19 has probably disrupted this number.

Energy Savings: NH spends $2.8B (2016) on carbon fuel for transportation, where 75% of that fuel money ($2.1B) goes out of state. Grid electricity may have a similar percentage of dollar flights as fuel due to out of state ownership. (A guess, but I'll assume no change to 2020.) However, a greater proportion of electric power is regionally owned, so some greater percentage of dollars have regional economic benefit, and therefore some benefit to NH. Solar electricity is an even better economic proposition, with one third of the system costs being NH sourced. Many NH EV owners have installed solar.

Ownership savings: EVs costing in the $30ks with 200-plus mile range have become a good fit for NH driving habits and pocketbooks. By 2022, there should be a selection of $25,000 EVs with 200+ mile range and used EVs are available at lower cost. The federal tax credit offers some savings in the short term, then the falling cost of batteries and EVs brings purchase savings in the longer run. I'll use an average purchase savings of $1500.

Grid electricity is about half the cost of gasoline and diesel per mile. Maintenance is one third of the cost. Yearly fuel-maintenance savings can total $500 to $1000 per year (about $750 for 15k miles per year) accruing for each NH owner. That's about $750 per year operational savings per PEV.

If all NH light duty vehicles were EVs:

There are about 700,000 vehicles in NH (2020 estimate), and one of 11 are purchased each year.

The EV's operating savings would be (700k vehicles x $750), about $525M per year.

Purchase savings would be about ($1500 x 60k vehicles per year turnover) $90M per year.

Energy Benefits: If half of that electricity were local renewables with 30% local content and considering more regional content in the grid electricity, the local benefit from energy would be about $100M per year.

Health savings might be about $250M per year (estimate). Total savings benefit from EVs is $965M per year times 10 years is about $9.6B!

But the economic benefit from local retention of money (local money circulation) is about 2.1 times.

So, the economic impact of all NH cars being EVs would be about **$2B per year** or **$20B over 10 years**.

Looking Shorter Term:

If 20% of NH cars are EVs, the economic benefit would be about **$400M per year** or **$4B over 10 years.**

With 2% of NH cars are EVs, the economic benefit would be about $40M per year or $400M over 10 years. This last case is close to valid as averaged over the next five years, but averaging over the first ten years would likely be double this amount due to the rapid growth of EV sales.

Again, these are my numbers gained from years following EV metrics and may not be accurate with deeper study. However, they are likely to be proximate (maybe +/- 10%). Even with proximal accuracy, the big takeaway is that electric vehicles appear to be **better for NH's EV owners and economy** than combustion vehicles. Please note that. Understanding this comparison is essential to discussions surrounding EV policies.

Randy Bryan is one of the co-founders of Drive Electric NH. Bryan has been an advocate for electric cars since 2006. His company, Plug-Out Power (formerly ConVerdant Vehicles), has converted vehicles to plug-in hybrids and currently develops and sells inverters that turn electrified cars into emergency generators. ♻

Electric Pickup Trucks: 2021

Cont'd from p.5


Tesla Cybertruck. (Tesla)

starting price of $39,900, and it has both respectable power and a range of 250 miles. Some people think it is stylish. Some people think it is horribly ugly (www.bit.ly/GET-Tesla-pickup).

The GMC Hummer is expected to appear late this year. Its starting price is $79,995. It will have a range of 250 miles and be powered by 1,000 hp of motors (www.bit.ly/GET-Hummer-pickup).

The Bollinger B2 is scheduled for release this year, with a 614-hp power plant and a 200-mile range. We are told it is to cost $125,000 (www.bit.ly/GET-Bollinger-pickup).

The Lordstown Endurance is expected sometime this year, with a 600-hp power plant and over 200 miles of range. Its price is $52,000 (www.bit.ly/GET-Lordstown-pickup). This vehicle is about the same price as a Ford F-150 Lariat 4WD, gets a $7,500 federal incentive, and costs about a third as much to fuel and maintain, according to the EVBite article cited above.

We suggest that anyone looking for a new pickup truck look into these, possibly order in advance, and have some patience until these models appear. Save some money now and stop worrying about the high cost of gas and oil. Get the power you need and come into our clean-energy future. They are coming soon. ♻

The Case for the Community Power Coalition

Henry P. Herndon

There is a new civic institution forming in New Hampshire. Its mission is to empower our cities and towns to realize their energy goals. It promises to transform our energy system, to enable local construction of renewable energy, and to empower customers with distributed energy innovations. It is called Community Power Coalition of New Hampshire. You are invited to be a part of it.

In this article, I first present some brief context about the formation of Community Power Coalition of New Hampshire, or "The Coalition." I then make the case for why New Hampshire citizens, cities, towns, and counties should join the Coalition to help lead the transformation of our state's energy system.

Context – How the Coalition Came to Be

In the "before times," on a brisk and snowy December afternoon in 2019, Clean Energy NH convened a gathering of municipal and county leaders. In attendance were city leaders from Keene, Concord, Lebanon and Nashua; volunteers and town officials from Warner, Hanover, Bristol, and a smattering of Upper Valley, Monadnock, and Seacoast communities; and staff administrators from Cheshire County. The topic at hand was maximizing the Community Power opportunity for the Granite State.

Earlier that year, Governor Chris Sununu signed Community Power into law, granting municipalities and counties the local control authorities to procure electricity and other energy services on behalf of their communities in aggregate. But the road to implementation was not yet clear. Ahead lay a fork.

The path to the left would leave each city or town to pursue Community Power on its own, relying on a mystifying network of brokers and middlemen for guidance. The path to the right led to Joint Action: the formation of a public nonprofit on which cities and towns could rely for transparent and accountable Community Power implementation.

Over the course of 2020, as national and global pandemonium reached a crescendo, a sub-group born of that December meeting chose the right path and stayed the course, adapting to our new virtual world. From Hanover came Town Manager Julia Griffin and Sustainability Director April Salas, fiercely determined clean energy leaders. From Lebanon, Assistant Mayor Clifton Below stepped up, the wizard of the legislature whose pen has transformed the state's energy markets time and time again. Cheshire County contributed two Administrators, Chris Coates and Rod Bouchard, steadfast trail blazers clearing the way for other counties and communities to follow. Lastly, from Nashua, Energy Manager Doria Brown joined, youthful and brilliant, on a mission to bring equity to energy.

www.communitypowernh.org

Alongside other community, technical and legal advisors, this diverse, cross-generational team of leaders pooled their resources and designed a new corporate body, a civic institution, one to be governed by community leaders to serve community needs. They named it Community Power Coalition, and in January, Hanover and Lebanon became the first municipalities to join.

The Coalition approach to Community Power is based on national best practices. There are many benefits of the Coalition approach, but two key aspects are (1) good governance; and (2) joint risk management.

Good Governance for Community Power

Community Power entails active management of many millions of dollars of electricity purchases and sales. It is important that the structure for governing those transactions is transparent, accountable and subject to oversight by representatives of the communities it serves.

Each city, town or county to join the Coalition may appoint a representative to the Coalition's Board of Directors. All governance level decisions will be made by the corporate body of the municipalities that make up the Coalition. This ensures that the Coalition's finances, power purchases, cashflow, and revenue are all transparent and controlled by the communities who make up the Coalition.

The Coalition houses technical and operational staff and vendors in a shared manner, making top industry expertise available to all members. Education is a core aspect of the Coalition's mission, helping local officials and community leaders learn about and navigate the power sector so they may make informed decisions.

Navigating the Waters of Energy Risk Management

Like navigating a river from its headwaters through its streams, and eventually through the pools and lakes, operating a large-scale electric power supply venture is complex and risky.

The headwaters of Community Power lie in wholesale electricity markets, where the Coalition will actively manage a portfolio of large-scale electricity contracts on behalf of its members. It costs money, people and time to manage wholesale power purchases. The Coalition enhances economies of scale, diversifies the risk pool, and shares operational costs across all members to maximize efficiency and eliminate redundancy. The Coalition will provide the expertise to jointly manage risks associated with purchasing large amounts of electricity.

From its wholesale headwaters, electricity must flow through the murky rivers of monopoly transmission and distribution utilities (and the statehouse and regulatory tomfoolery that come from them). Utilities are well known for their outsized influence over state legislative and regulatory affairs. Together, the Coalition is best equipped to fully understand the nuances of state utility regulation, neutralize risks (like House Bill 315), and work together to ensure smart policies and regulations that maximize our ability to innovate and create value for our communities.

Ah, and welcome dear reader, to the lakes and pools, the retail establishments and homes where human beings gather to live, work and play. Community Power and the Coalition present many opportunities to lower costs and innovate in our retail electricity markets. We can prioritize sourcing power from our residents' rooftop solar arrays, and other local power sources. We can design time-of-use rates for distributed energy storage and electric vehicle charging. We can partner with NHSaves to improve energy efficiency, conservation, and load management programs for our communities. The Coalition will empower individual cities and towns to innovate on energy, and provide a means to share those innovations across its membership.

Credits: The Coalition would like to thank the following members of the Organizing Group: Dori Drachman, Mary Day Mordecai, Ned Hulbert, Tad Montgomery, Everett Hammond, Andrea Hodson, Dr. Amro Farid, Samuel Golding, and Michael Postar. The Coalition also recognizes the countless citizens, public servants, industry professionals, and energy committee members who have contributed and will continue to contribute to New Hampshire's Community Power saga.

Henry Herndon is a community organizer and an expert in energy policy. He is currently under contract with the City of Lebanon to support the launch phase of Community Power Coalition. ♻

Thinking Locally to Confront a Global Problem

Vital Communities

Combating climate change takes national and global action. But it also depends on work we do here, in our local communities.

Promoting citizen-driven, community-level action in the Upper Valley is the goal of the Climate Change Leadership Academy (2CLA). From March through June of this year, 22 people from across the region are meeting for seven sessions to learn the latest climate information and devise projects to help their communities adapt to climate change or reduce climate-warming emissions.

Cecily Anderson of Tunbridge, VT, a participant in the 2019-20 pilot of 2CLA, spoke at a February 2020 2CLA session. Subsequent sessions have been held online. Photo by Chris Johnson.

The program is offered by the Upper Valley Adaptation Workgroup (UVAW), a group of leaders and partner organizations striving to make the region more resilient to climate change, coordinated by the Upper Valley nonprofit Vital Communities. Prior knowledge of climate change is not required, and the $30 tuition is waived upon request.

"The impacts of climate change have never been so clear and concerning; record-high wildfires, hurricanes, and temperatures, another summer drought here in New England, and rising sea levels," said Erich Osterberg, UVAW vice chair and associate professor of earth sciences at Dartmouth. We need to empower citizen leaders to help our local communities reduce greenhouse gases while also becoming more resilient to the climate changes that are already happening."

Along with the latest data on climate change and strategies for its adaptation and mitigation, the 2CLA curriculum includes "design-thinking," a structured approach to planning projects. Participants also will learn how to seek and incorporate input from the most climate-vulnerable populations into the project design.

The group itself represents a range of Upper Valley people and interests. "Folks from all over the Upper Valley applied to take part in the Climate Change Leadership Academy, from high school students, to small business owners to retired community members," said 2CLA Coordinator Caroline Wren. "We understand that this past year has been tremendously difficult, and we are grateful that we received so many passionate applications from folks who are inspired to develop community-based projects to address climate change in the Upper Valley."

One participant is Louisa Spencer, co-owner of Poverty Lane Orchards in Lebanon, NH. "Our family is trying to figure out how to adapt our very varied orchard and forest property into a force against climate change, and an example of how others can do the same, both on small- and large-scale," she wrote in her application. "We have experienced climate change first-hand, with weather records that show orchards breaking dormancy weeks earlier than in the '60's. We produce food locally and would like to figure out how best to enhance the climate benefits of local food without charging the high prices typical of local food, also to set up ways local residents can lay in and store local food."

When facing a huge, existential issue like this, thinking local can be helpful, wrote Amanda Porter, a consultant to businesses for the Springfield (VT) Regional Development Corporation. "One of the reasons I am interested in this program is because it is 'local' and allows for focus on one's own community. I think discussing climate change in relation to what we can do in our own communities removes some of the overwhelm and anxiety." ♻

CAMP W: SOLAR... AND SO MUCH MORE!

George Harvey

The 21.7kW DC rooftop solar array with 66 Hanwha modules and an Enphase microinverter system was installed by Southern Vermont Solar at Camp W's dining hall. It provides all of the camp's electrical needs. (Photos:Camp W)

When we started working on an article about Camp W, it was going to be about the solar array that covers nearly the entire roof of the dining hall. It is an impressive system, installed by Southern Vermont Solar, providing the electricity used by the camp and collecting credits when the camp is not open.

Talking about that system with Sean Ashcraft, the camp's director, made us realize there was a lot more to Camp W that would be of interest to our readers than just a solar array. The camp's approach to life and the environment dictated renewable electricity, but that approach extends to touch just about everything that goes on at the camp, and that includes everything that touches on the lives of the campers while they are there.

Camp W is in the hills to the west of Brattleboro, Vermont. The campers can be as young as four years old, and as old as seventeen. The goal of the camp is to connect each child with nature and natural cycles as fully as possible. Included in that approach is a recognition that we human beings are part of nature, and so our health and well-being are given high value.

All aspects of living are touched by the camp's approach to living, and activities go beyond what we might think of as common at camps. The camp's work with food provides an excellent example.

Camp W is getting increasingly reliant on growing its own food, using systems that are based on organic farming. Campers do much of the gardening, including such things as learning to identify problems that might come up in the garden and harvesting to increase yields. Kids harvest eggs from the camp's chickens. Eggs are just about the only things on the menu that are not vegetarian, and a vegan menu is optional. Even the youngest campers, who may be four years old, participate in gardening, doing such things as looking for bugs and picking cherry tomatoes. The kids also get some experience with wilderness cooking. The chef is a dietitian with a master's degree in food health.

Campers work in the gardens to grow their own food using organic gardening practices.

To a great degree, the kids participate in maintaining their own health. They are taught how to use filters for water they get from springs, including filters they make themselves. They check for ticks regularly. The camp teaches them how to keep comfortable when the days are wet and cold. The kids help with composting. They are able to learn that even their urine has value as it is collected by the Rich Earth Institute. The camp has a nurse to attend to any issues that might come up.

There is a lot of bush craft on the agenda. The kids learn to make spoons and bowls. They also learn firecraft, making fires with and without birch bark as kindling. Arts and crafts are related as much as possible to the real world, and the campers also learn about carpentry in general.

The things we might think about as camp activities are not neglected. Children swim daily. They climb trees and rocks. They go on hikes and maintain the trails. They camp out overnight. They sing, tell stories, and do theater activities.

Camp W has up to about 120 kids participating, of whom up to 90 live at the camp for their stay there. Of course, the camp has had to adapt itself to the realities of Covid-19 in the last year. The system in use requires children to quarantine at home for two weeks prior to camp, and then while at camp, they are pretty much isolated with the staff and each other.

Camp W is a non-profit organization. Potential campers in need of financial help financially can apply for scholarships. But the camp also works for general benefit of all in other ways. As we mentioned above, the solar array on the roof of the dining hall is big enough to supply all the electricity the camp uses while it is in session. When it is not in session, the array continues to supply electricity, which is banked by Green Mountain Power. Families in need can apply for help, using those credits to lower their costs.

Camp W's website is www.campw.org. *(See Camp W's ad on page 20)* ♻

A girls' hiking group from Camp W.

14,500 kWh of Solar Provide Power+ for Kroka Expeditions

George Harvey

There are places where electricity is not the only product of a solar array. Kroka Expeditions is one of them.

Atop the old farmhouse, which is quite large, there is a solar array, which was installed by ReVision Energy. It has 37 panels. They provide about 14,500 kilowatt-hours of electricity, eliminating production of well over 15,000 pounds of carbon dioxide, each year. This solar array is important for providing Kroka Expeditions with renewable energy it needs to meet its climate goals. But it has another importance that must not be overlooked. It is a part of a way of life that is handed down to the students being educated there. It is central to a connection to nature that provides students with a special understanding of how they fit into nature because along with the farming and connection with the wetlands and forest, it is a focus of education, teaching students ways to be part of nature without disrupting it. That is a message we all should learn.

While this is an impressive amount of solar, Kroka Expeditions offers much more sustainable experiences. If we tell you that Kroka Expeditions is a school, we would be telling the truth, in a way. But the vision you might get from that statement is so far from reality that more explanation is necessary. A better statement might be that Kroka Expeditions is non-profit organization that offers young people learning experiences built around connections of self with nature, community, and the resources we need for life. It gives its students insights that are simply not available in a conventional school, and they range from such things as growing the food they eat to going on lengthy adventures into the natural world.

Kroka's new farmhouse in July 2020 with the photovoltaic solar array fully installed. (Photos: Kroka Expeditions)

Rainwater catchment system on Kroka's new farmhouse.

Misha Golfman and Lynne Boudreau founded Kroka in 1996 as a summer camp program for the Hilltop Montessori School in Brattleboro, Vermont. It took advantage of the location, including stream and forest sites. Golfman has said, "Nature is a great teacher," and Kroka took advantage of the skills nature provided. In time it grew to include not just forestry and farming, but a range of subjects from wilderness living to examining sustainable small building design. It has programs that start with gathering the resources to build a canoe and only end after reaching a goal hundreds of miles away.

Kroka has moved and grown. Now it is on a 120-acre site in Marlow, New Hampshire. It has wetlands, farmland, and forest. Students participate in the farming and in the life of the community, as they grow food and split wood in addition to activities that vary by season and program. And yes, that does include accredited work in a standard curriculum.

Students can attend for relatively short periods, a full semester, or longer. There are expeditions that go rather far afield. Some students sail and paddle their way from the Canadian border to New York City. Some have explored the Rio Grande. The opportunities are changing, and they seem almost endless.

The school is based on the Waldorf system of education, and to some extent on the Montessori system. According to its website, "Some of the observations and insights of Rudolf Steiner are woven into Kroka's practices, from biodynamic gardening and the use of homeopathic medicine to Goethean observation."

With that background information, the reader might not be particularly surprised to learn something, though it also seems rather astonishing. Kroka's main building, a 200-year-old farmhouse, is being painstakingly renovated based on the standards of the Living Building Challenge (LBC). Readers of *Green Energy Times* may recognize the LBC standard as a goal that is challenging to achieve in a new building. (For more information on the LBC, please see, "Wright Builders, Inc. Develops EarthKind Homes," in the January, 2021 edition – www.bit.ly/390qSue).

The Living Building goals require attention to detail relating to everything in the structure and how it impacts the natural environment around it. Energy has to be examined, just as it would in a building that is to have net-zero emissions, but the same is true of all the materials the building is made of, including how they were produced and how they got to the site. And it is true of water, waste, areas around the building and so on.

Misha Golfman told us, "We completed a fully regenerative building, disconnected from fossil fuels. It uses only local resources." Water and food come from sustainable sources, waste is composted or used for sustainability. It is important that they have achieved operations which are completely free of non-sustainable energy sources. No fossil fuels are used for light, heat, or operations. Firewood is harvested for heat. And the electricity all comes from the sun. (See Kroka's ad on page 20.) ♻

Spring Equinox at the 45th Parallel

– Halfway to the Center of the Planet –

Doug Cogan

On March 20th, the equinox tends to bring on warm thoughts about the long, sunny days ahead. For those who like living with a "sense of place," northern New England has something really special to offer: a spot on the North American continent where the days start getting longer than the nights right as the vernal equinox marks the official turn of winter into the spring.

This wonderful celestial symmetry comes with the territory. We inhabit a place that's easy to spot on any classroom globe. It's the 45th parallel, marking the halfway point between the equator and the North Pole of the of the Northern Hemisphere. We colonists of this 45th parallel are much too diverse a group to claim any common heritage. But if we were to take a trip around the globe, staying to our common ground, we could set out from Eastport, Maine, enter Europe at the northern tip of Spain, cross the Alps and then the Gobi Desert in Mongolia, before reaching the Pacific Ocean at snowy Hokkaido, Japan, with final stops in Portland, Oregon, and Minneapolis, Minnesota, along this 17,500-mile, circumpolar journey.

Goldilocks in Reverse

From a weather standpoint, you might say we 45th parallelers live in a "reverse-Goldilocks" environment. While it can get "too hot" or "too cold" on occasion, our weather usually seems to balance out "just right" over four celestial seasons.

Or at least we used to think so. Now a lot of weather observers in our neck of the woods think the weather is falling out of kilter. The "too-cold" temperature rarely gets below zero anymore. The "ice-out" dates on frozen ponds are coming sooner and becoming more unpredictable. More people are planting spring flowers before Memorial Day and getting away with it. Indian Summer is just getting started on Columbus Day, when it used to be winding down; now it can last practically till Thanksgiving. Compared to the climatic stresses that other latitudes are feeling because of global warming, these weather changes are relatively mild -- and not entirely bad! Here's what some 45th Parallel weather observers told the Boston Globe about recent weather changes in our area (see Heard along the 45th parallel).

Let the Sun Shine – on Northern New England!

From a solar standpoint, northern New England ain't so bad, either! When the sun makes its spring debut this Saturday, it will be halfway through its northerly pass of the Northern Hemisphere, with the longest days of the year starting in the weeks ahead. By the time we max out on daylight hours on the summer solstice, June 20, solar power in our neck of the woods will be turning photons into electrons for 15 hours and 15 minutes straight – leaving less than eight hours of darkness before the morning sun starts the process all over again.

So, for those who watch the sun arc over our 45th parallel from afar, we may look like distant castaways at some remote northerly outpost. Yet, we who are the ones truly in the middle of it all, hunkered down in just what might be might be the right place at the right time to weather the coming storm of climate change – and whatever else the whole wide world might throw at us!

Photo from the NH Division of Historical Resources

45th Parallelers Unite!

And we're not alone! Here's how our fellow 45th parallelers at the Minnesota Museum of the Mississippi, in the small town of Cadett, Wisconsin, see our shared place in the world. For these "Middlesotans," camped out some 1,500 miles inland of here, weather extremes cancel each other out to create one of the most temperate places on earth, and extreme weather is just about as extreme as anything there ever seems to get:

"In an intemperate world, here is the most temperate place in the temperate zone (emphasis added). It is an idealized midpoint between extremes of cold and heat, the center between the Apollonian rationality of the frigid north and the Dionysian turbulence of the torrid zone to the south. This pride in "middleness" may be strongest in the mid-continent regions the 45th traverses, in North America as well as in Europe, where residents seek a cultural midpoint distinct from the dominance of the coastal fringes, and the swings of continental weather are a seasonal reminder of the possibilities of extremes. As with anywhere, homeland pride can inspire both parochial isolation as well as a sympathetic global point of view."

Map of the international border at the 45th parallel, modified. Bazonka, CC-BY-SA 3.0, www.bit.ly/3stJlXv

With spring erupting, let us rejoice in living in the best place at the best latitude on the planet, and enjoy the long, sunny days ahead!

Learn more about Solaflect at solaflect.com. Contact info@solaflect.com or call (802)649-3700.

Doug Cogan has lived in the Upper Valley for 33 years and devoted his entire career to finding actionable ways to address climate change. He has written several groundbreaking books on the development of renewable energy, and helped retrofit Plainfield, NH school classrooms with highly efficient heat pumps and helped get solar installed during his time on the Plainfield School Board.

Reprinted with permission from Solaflect's blog at https://www.solaflect.com/spring-equinox/. ♻

Read more on p.11>>

Heard Along the 45th Parallel...

The *Boston Globe** spent time this fall and winter visiting and talking about the changing climate with more than 80 people who live and work in Northern New England. Here are some of the observations.

Colebrook, NH: "I worry about the snow - a lot of businesses in town rely on it and we don't get it like we used to." – *Beneit Lamontagne, selectman;*

East Charleston, VT: "In our Christmas bird count, we've definitely seen more American crow, which are usually more southern. Ravens, which are more northern, have decreased. The common denominator seems to be a warming climate." – *Jayson Benoit, Operations Director North-Woods Stewardship Center;*

East Burke, VT: "The last three years have been off the charts bad. After last year, people were saying we can't have another bad year and here it is. It's a wake up call that certain businesses can't be solely dependent on winter outdoor recreation." – *Tim Tierney, Vermont Department of Economic Development;*

Shelburne, VT: "The weather is less predictable. We are seeing more extremes, rain and droughts." – *Sam Dixon, dairy farm manager, Shelburne Farm;*

Kingfield, Maine: "We live here because we love winter. In December, my husband printed up T-shirts that gave instructions for a snow dance on the back because we wanted to lift people's spirits. We hoped it would snow right away, but it took a while." – *Amy Grant, who with her husband, Jon, owns a farm;*

Baring, ME: "We get a lot more freezing rain and ice, so the roads are icier." – *Peggy Sawyer, office assistant, Moosehorn National Wildlife Refuge;*

Palmyra, ME: "We're always ice fishing by the first or second week in January. But it's mid-January and we haven't put the shack in yet." – *Pat White, ice fisherman;*

Errol, NH: "I'm terribly worried about the weather. When there is no snow, the snowmobile market is destroyed. No one wants to buy them, people don't bring them in to be fixed." – *Ron Watson, All Seasons Sports;*

Barre, VT: "It used to be colder, I remember walking in the woods when it was 25 or even 40º below zero, We don't get those anymore." – *Marjorie Strong, librarian at VT Historical Society.*

**Source: www.bit.ly/3fkPDVG.* ♻

Renewable Energy Secures Military Functionality

George Harvey

Oxymoron is a word for a term that appears to be self-contradictory, such as "jumbo shrimp." An old friend of mine had a bumper sticker that read, "I was an oxymoron." In his case, it indicated that he once worked military intelligence. The military can be very aware and forward-looking. On the other hand, it can sometimes appear to be very obtuse.

Ribbon-cutting for a solar micro-grid at Fort Hunter Liggett, CA. U.S. (Army Corps of Engineers Sacramento District, public domain. www.bit.ly/2PlFNs4)

An example of looking forward and seeming obtuse is the history of paddle-driven steamships. The first fully steam-powered ship in the U.S. Navy, the Fulton, was commissioned in 1816. It was not a trivial ship; it had 32 large cannons aboard. But while paddle driven ships were obsolescent in the 1840s, the last two weren't decommissioned by the Navy until 1945. Even more shocking sounding is the fact that they were both aircraft carriers, based in Chicago.

As a young officer, George H. W. Bush learned to land naval aircraft on a side-paddle aircraft carrier, the USS Sable. The navy had obtained two passenger lake ships that were not in use and converted them to aircraft carriers for training, operating them on Lake Michigan, where they were safe from attack. It might have been a smart move, but we can easily see that the story would sound crazy if it had just been left as, "The U.S. Navy had two side-paddle aircraft carriers." The point is that the military does things for strange reasons sometimes, but the reasons occasionally turn out to be valid, regardless of how strange they might appear.

For many years, Members of Congress have tried to limit the military uses of renewable energy. Often, the motives for such limits seem to be just common sense. Several years back, there was a proposal before the Congress to disallow the armed forces from using energy sources that cost more than conventional forms in use. To many people, this seemed like a reasonable attempt to keep the military from experimenting in renewable energy, which was very costly at that time.

When Pentagon personnel testified to Congress, however, what they said was that investments in renewable energy were paid for many times over in protecting lives and material. At that time, lives, vehicles, and other material were being lost because of the need to move petroleum-based fuel by convoy to camps in Afghanistan. Putting up solar panels or wind turbines with batteries could prevent some of those losses. Comparing energy technologies using such obvious criteria as price per unit of energy alone could cost a lot of money and the lives of service personnel.

It is not just in combat areas that renewable energy has become important. Military bases cannot be guaranteed to provide their national security functions if they are dependent on grid power and the grid has gone down. For that reason, they have had their own microgrids which can cut themselves off from the grid and continue to operate when grid power is not available. In the past, this functionality was provided mainly by diesel generators. It is not a perfect solution, being dependent on fuel.

A far more reliable source of energy for a microgrid is renewable resources backed up by battery. And as things have been developing, renewable resources are now getting cheaper to install and much cheaper to operate.

National security depends on many things. In an age dependent on fossil fuels, they become an object of concern. In the past, we have been put into economic slowdowns because of lack of fuel, and we are especially vulnerable to interruptions in the fuel supply. Though there are reports that the U.S. has become a net exporter of oil and gas, Energy Information Administration data for 2019 show that the U.S. produced 19.25 million barrels of petroleum per day, but it consumed about 20.46 (www.bit.ly/3fie8CU). The shortfall of 1.23 million barrels per day leaves us vulnerable to external disruption, and our internal infrastructure can also be vulnerable to attack. When our military is operating on renewable energy, it is far more resilient.

A 2nd Air Refueling Squadron KC-10 Extender prepares to refuel a B-2 Spirit. Replacing fossil fuels is a seemingly insurmountable challenge and opportunity. But it can be done. (Senior Airman Keith James, USAF, public domain www.bit.ly/3sq7Y7K)

These are examples of areas where renewables are being used to replace fossil fuels to advantage. There are other areas that need to be addressed, such as fuels for aviation. The difficulties of long-range flight are often spoken of as insurmountable without fossil fuels. A recent article published in Proceedings of the National Academy of Sciences, however, shows how even aircraft can be renewably powered by fuel derived from food waste (www.bit.ly/3sqjVtT).

It happens that the U.S. military is very aware of the problems of the pollution and climate crises, which are security issues themselves and have begun to diminish military functionality. It is also working on those issues as it shifts toward renewable energy sources. ♻

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.

• Retails 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**

• **Windham County**

• For residential low- and moderate-income residents there is a pellet stove program. Contact the Windham and Windsor Housing Trust for more information: Tara Brown at 802-246-2119

In Rutland & Bennington County (and towns in neighboring counties that boarder Rutland Co.) contact Melanie Paskevich mpaskevich@nwwvt.org at NeighborWorks of Western Vermont, (802) 797-8610.

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.

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 from 2011 to 2016. For solar, small wind, and fuel cells this constitutes a 6.24% state-level credit for systems and for geothermal electric, microturbines, and combined heat and power systems, this constitutes a 2.4% state-level tax credit.

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

• 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.

Residential New Construction

• Enroll to receive a home energy rating, expert technical assistance, and incentives – Efficiency Vermont Certified™ projects receive up to $4,000 cash back

• Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives

Other Opportunities to Save

• Home Energy Loan – finance up to $40,000 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.*

Electric Lawn Mowers

• Incentives for commercial and residential battery-electric lawn mowers and some tools are now offered by all of VT's electric utilities, including:

• VEC (www.bit.ly/VT-mowers-VEC);

• WEC (www./bit.ly/VT-mowers-WEC);

• BED (www.bit.ly/VT-mowers-BED);

• VPPSA (www.bit.ly/VT-mowers-VPPSA);

• Stowe Electric Company: (www.bit.ly/ VT-mowers-SEC);

• GMP (www.bit.ly/VT-mowers-GMP).

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.

• ADVANCED 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.

While we at Green Energy Times try to keep things up to date, incentives are always changing. Be sure to check with the appropriate sources for the latest information.

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

NH PUC: Get up-to-date information at https://www.puc.nh.gov/Sustainable%20Energy/RenewableEnergyRebates.htmls

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 CISolarRebate@puc.nh.gov or at (603) 271-2431.

For C&I solar program details, go to: www.puc.nh.gov/Sustainable%20Energy/RenewableEnergyRebates-CI.html.

Residential Solar/Wind Rebate Program

-Effective January 2, 2018, 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 at http://www.puc.state.nh.us/Sustainable%20Energy/RenewableEnergyRebates-SREG.html*

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

www.puc.nh.gov – Sustainable Energy or tel. 603-271-2431 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 Electric Cooperative Incentives for Electric Vehicles and Electric Car Charging Stations

- NHEC offers a $1,000 incentive on a Battery Electric Vehicles (BEV), $600 on a Plug-In Hybrid Electric Vehicles (PHEV), and $300 on Electric Motorcycles.

NHEC offers incentives for Level 2 Electric Vehicle Charging Stations.

For Commercial and Municipal Members – Incentives are up to $2,500 per charging unit. A maximum of two charging units may be installed off-peak hours at a rate that is lower than the basic residential rate.

NHEC's ENERGY STAR Heat Pump incentive structure for 2020 is as follows:

Heating and Cooling - (Must meet or exceed the minimum efficiency requirements - SEER 18/EER 12.5/HSPF 10) $500 per ton.

Geothermal - (Must meet or exceed the minimum efficiency requirements - EER 16/3 COP) $500 per ton

Cooling only - (Must meet or exceed the minimum efficiency requirements - SEER 15/EER 12.5/) $70 per ton

Wi-Fi thermostats - (Must be installed with a heat pump also receiving an incentive) $100 rebate per T-stat

Weatherization Bonus – (Available for members participating in the Home Performance with ENERGY STAR Program) $250 per ton

Whole House Bonus – (Available for qualified heat pump applications that offset 80% or more of the total heat load. Two years of fuel use history is required) $250 per ton

ENERGY STAR Heat Pump Water Heater – (Must meet or exceed 2.3 energy factor) $750 rebate on 40-80 gallon heat pump water heaters

Loan Buy down – NHEC provides interest subsides through participating banks and credit unions for the installation of qualified heat pump installations. Must get pre-qualified. Loans up to $15,000 after rebate.

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 https://www.nh.gov/weatherization.htm for application criteria, FAQs and local program contacts.

Community Development Finance Authority (CDFA) Clean Energy Fund

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

to support energy efficiency and renewable energy projects.

Small Business Energy Audit Grants

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

Community Facilities Energy Assessment Grants

Non-Profits and Municipalities can apply to receive a grant covering 75% of the cost for an energy-related study.

Find out more at: nhcdfa.org/energy.

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

Why the New Tax Credit for Biomass Heating Systems is Good for New Hampshire

Joshua Singer

Efficient biomass heating systems, such as those fueled by locally-sourced wood chips or pellets, are a great way to update your old oil or gas boiler systems and save money at the same time. The upfront cost of these systems is slightly higher than fuel oil or gas boilers, but they offer on average 30% savings over oil and propane over five years, making it a stellar investment for your home.

An exciting new offering is now available to assist in the transition to heating with biomass. As of January 2021, EPA-certified wood heating systems that have an efficiency above 75% have been eligible for a Federal Investment Tax Credit (ITC). This 26% credit can go towards the total purchase and installation cost. The ITC expires on December 31st 2021 and is reduced to 22% through 2023.

The EPA has a helpful list of which wood heaters qualify and how to purchase them. In addition, there are many qualified installers and fuel providers right here in New Hampshire. This is particularly helpful to residents who have been using a wood stove, oil furnace, boiler, or propane heat and would like a new unit that is more efficient, uses less fuel, and can support the local economy when harvested sustainably and from local sources. Modern biomass systems incorporate robust emissions-capture technology, making them much cleaner than old models.

New Hampshire has a history of supe-

rior sustainable forestry and when using a biomass system, you can be proud that your fuel purchase is going towards your local economy. Using our forests as sustainably as we can is also a benefit. By using sustainable forestry practices to harvest wood, keeping old growth areas intact, landowners can keep their land forested, and this translates to better environmental practices than any potential development.

New Hampshire is 84% covered by timber forests, making it the second most forested state in the country. Of those forests, 76% are privately owned. Currently, forest growth is exceeding harvests by 49%, meaning many more trees are regenerating than are being cut, and we can use this plentiful, renewable resource to help our citizens and our economy.

Modern wood heat boilers re-fuel themselves, ignite, extinguish and can be monitored via cloud-based software. High quality wood pellets used in boilers burn clean and produce no

Cont'd on p.24

Renewable Energy at our NY and VT Statehouses

George Harvey

Two of the states in the Northeast made some progress with renewable energy projects at their statehouses recently. One is New York; the other is Vermont. The changes made at these statehouses address entirely different issues in entirely different ways.

The issue in New York was a change in plans for energy at the Empire State Plaza in Albany. Changing plans might not sound like much, but in this case, it has huge consequences. The issue is heating and cooling for the New York State Capitol and the buildings at the Empire State Plaza, which stand before it.

The capitol building, which dates to the 19th century, seems big, until we consider the size of the Empire State Plaza (ESP), which was built in the 1970s. The ESP is made up of ten buildings, five of which dwarf the capitol building visually. The largest of these is the 44 story Corning Tower, the tallest building in the state outside of New York City. Four buildings, called the agency office buildings, are each 23 stories. These buildings were built in the period 1965 through 1976.

Heating and cooling the government buildings at the Plaza was done using steam from a heating plant in the neighborhood of Sheridan Hollow. This plant was connected to the buildings it served using an underground pipeline a half-mile long. The energy came from burning coal, oil, natural gas, and trash. It was polluting, and the people who lived in Sheridan Hollow suffered the consequences.

The Empire State Plaza in Albany. Kurtman12208, released to the public domain. www.bit.ly/3cTlzwv

Vermont Statehouse in the fall. Bob P. B. CC-BY-SA 2.0. www.bit.ly/2QmSPpr

In 2015, the New York Power Authority (NYPA) proposed installing a microgrid at the Sheridan Hollow site that would provide both heat and power for the government buildings. Not all microgrids are equal, however. In this case, the heat source for the microgrid would be natural gas.

While breathing the exhaust from a natural gas plant might be marginally better than breathing smoke from coal and trash, natural gas is hardly a solution to pollution or climate change. So predictably, there was opposition to the plan. This opposition came to a head when Jay Egg of Egg Geothermal and Keith Schue, technical advisor for Sheridan Hollow Alliance for Renewable Energy (SHARE), pointed out some of its flaws. One was that the plant would be rendered obsolete by current law well ahead of the end of its expected lifetime, because it would become illegal to operate it. Another problem was that natural gas was already not the least expensive way to get the heat and cooling.

In 2019, the NYPA changed the original $88 million plan to a combination of solar power and geothermal, authorizing a $30 million budget. And now, the plan is on a trajectory to save the money of people who pay taxes and the health of people who breathe. Egg and Shue were awarded the 2020 Constellation Prize for Policy Impact for their work on championing renewable energy and moving Empire State Plaza away from fossil fuels.

Another change has come about at the Vermont State House in Montpelier. In terms of scale, it is more modest, but it is also uniquely forward-looking. The State of Vermont now has an emergency backup system that will provide clean energy for its statehouse in the event of power failure. Interestingly, it is the first state to have such backup for its capitol.

Describing the work done to achieve this, Vermont Governor Phil Scott said, "I know many think clean energy must be more expensive, but the work done today shows not only can we reduce carbon emissions, but if we are strategic, we can also save money in the process." He can be seen speaking on the effort in a video at www.bit.ly/Vermont-battery.

The statehouse had been reliant on a diesel generator to provide backup power in the past. Switching to the new battery system is expected to save the state $44,000 over the next ten years because the costs of fuel and maintenance of the diesel system are much higher than the cost of a new battery. Another aspect to this is that unlike the diesel system, the battery can switch on automatically, without delay.

The battery system at the statehouse will also help support the grid by providing it with power as it is needed. This adds to the savings for the state, but it also reduces energy costs of all customers of Green Mountain Power.

A number of organizations and businesses contributed to the switch to battery power for the Vermont statehouse. They include a team from Renewable Energy Vermont, Northern Reliability, Dynapower, Green Mountain Power, and others. Also, Governor Scott thanked the legislature for its help on the issue. ♻

New Hampshire Sustainability Innovation

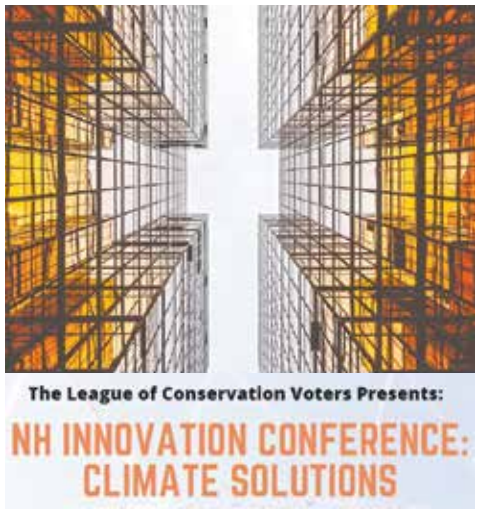
CONFERENCE RECAP

Randy Bryan

New Hampshire Climate Action (of the League of Conservation Voters) held a first NH Innovation Conference for Climate Solutions via Zoom on February 24. It was well organized by Seth Paulson-Sacks of Climate Action. Panelists were NH State Senator Tom Sherman, ReVision Energy's Kimberly Quirk, University of New Hampshire's Clay Mitchell, and me, of PlugOut Power.

While every one of the panelists agreed that New Hampshire was well behind our neighboring states in promoting a sustainable economy, all had practical ideas and suggestions on how to make progress. All agreed that solutions would be intertwined with state government, the Public Utilities Commission and the utilities.

Among the positive developments, State Senator Tom Sherman said that Governor Sununu has recommended opening a State Office of Energy to consolidate and give momentum to state energy plans. Senator Sherman also expressed some optimism that the five-megawatt municipal solar limit could pass. He suggested that more aggressive policies coming from the new administration would push NH to become more progressive toward sustainable policies.



Kimberly Quirk discussed the importance that batteries will play in the energy economy and how we need to pursue multiple energy and thermal solutions.

Clay Mitchell brought out the need for higher level thinking about energy markets, regulation, and NH's policies. And he pointed out the fast-coming need for more renewables, batteries, and smarter grids.

Transportation was my topic, and I talked about the need for more electric vehicles (EVs) and consequently my recommendation to join the New England Zero Emission Vehicles Mandate coalition. I also talked about nurturing small companies with policies, funding, and procurement practices. Rebuilding the Incubators and Investor networks are among the most needed resources for innovation.

I sincerely hope the NH Innovation Conference for Climate Solutions turns into a series. It could be a wonderful forum in which to get discussions going on NH Sustainability Policies and Projects.

Randy Bryan is one of the co-founders of Drive Electric NH. ♻

Edging Ever Closer to 100% Renewable

Hanover, New Hampshire

Nancy Serrell and Robert Taylor

"Change is happening," says Yolanda Baumgartner, co-chair of Sustainable Hanover, the town committee working with officials to accomplish Hanover's commitment to 100% renewable energy. "We are starting a new chapter on the road to clean energy."

Solar. In the four years since Hanover's residents voted at their 2017 town meeting to commit to the Sierra Club's national "Ready for 100" initiative, significant milestones are within sight for the first of three goals – to transition electricity to renewable sources before 2030. By this summer, an estimated 92% of the town facilities' electric power will be from in-town solar. Residents are on track to double the number of solar homes from 125 in 2018 to 250 in 2021. Solar panels are also scheduled to be installed for 42 apartments at Hanover's new affordable housing community on Summer Street.

A 68 kW solar system at the Water Reclamation Facility in Hanover. Images courtesy of Sustainable Hanover, unless otherwise noted.

For residents and small businesses without their own solar generation, the town will seek voter approval when the final work on the NH Community Power Coalition is completed. The NHCPC will allow Hanover and several other towns and cities to aggregate their buying power to provide affordable renewable electricity to all of their residents and small businesses. Meanwhile Hanover's largest energy user, Dartmouth College, has adopted its own Green Energy Policy with renewable energy targets consistent with the town's. Since 2017, Dartmouth has installed solar on 14 campus buildings. More is planned.

The commitment. Hanover was the nation's 29th community to sign on to the Ready for 100 initiative. The town pledged to achieve 100% renewable sources for electricity by 2030, and for heat and transportation by 2050. It was audacious. Hanover's vote covered not just municipal facilities but the entire town.

There were fears and concerns. "This has never been done – we couldn't point to a prototype," Baumgartner says. Questions abounded. Some wanted a detailed roadmap with cost projections. Was the technology ready or affordable? Could the effort be inclusive? What if the town's biggest energy consumers, such as Dartmouth College which is responsible for roughly half of all energy usage, demurred?

Immediately following the vote, Sustainable Hanover named an Energy taskforce with 14 enthusiastic members. Their first year was devoted to building a foundation for the enormous task ahead. The consulting firm 3Degrees, which helps organizations implement renewable energy solutions, worked with the group to develop a strategy and set of guiding principles, which included the values of inclusivity and equity.

Addressing heat and transportation. With the electricity effort well underway and a growing corps of volunteers, Hanover has begun to address the transportation and heating sectors. Increasing efficiency is a major consideration for reaching 100% renewables for heating and cooling. An invigorated Weatherize Hanover campaign is operating year-round to encourage residents to reduce fuel consumption. For businesses and nonprofits, the town is hosting a Liberty Utilities consultant, whose project has generated $120,000 in NHSaves incentives for energy-efficiency improvements. A "Window Dressers" project will build and install low-cost window insulation inserts suitable for homeowners and renters. Nearly all town offices have converted to electric heat pumps instead of oil and gas boilers. A building code proposal is being studied for the town to adopt higher energy-efficiency standards than those mandated by the State.

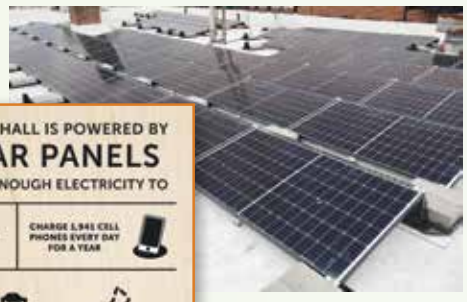
Solar panels will be installed this summer to power the affordable senior apartments at the new Summer Park in Hanover. The project was built through Twin Pines Housing. Image: Banwell Architects.

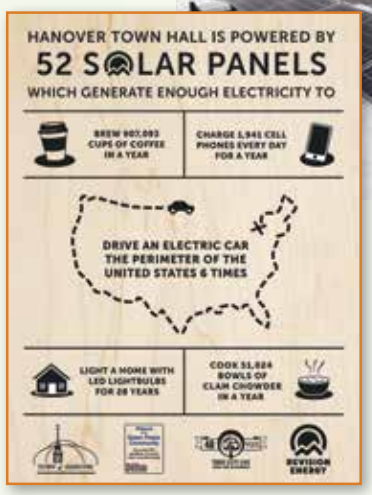
Sustainable Hanover's strategic plan called for giving attention to transportation when electric vehicle options are ready for mass adoption. Recognizing that the moment had come, the group formed an EV team last year. It is developing as a community resource for information about EVs and chargers and has established a network of EV owners who are available to answer questions about EV ownership in the Upper Valley. A popular e-bike library loan program, which introduced 65 residents to electric bikes as a low-carbon alternative to cars for in-town errands and commuting, will be repeated in May. A town study is underway to identify ways to improve the bike and pedestrian experience on Main Street.

The road ahead presents opportunities and challenges. Hanover has an invaluable asset in the supportive network of individuals and groups who are committed to reaching the 100% renewable energy goal. More than 30 volunteers are active participants. Equally priceless is the support of Town Manager Julia Griffin and town department heads, who are as committed as its most engaged citizens.

A major challenge as Hanover expands into heating and transportation is the difficulty of gathering community-wide data. Liberty Utilities, which serves all but a small number of Hanover users, provides aggregated reports on electric consumption. These reports show that kilowatt hour usage for Hanover has declined by 15% since 2013. Comparable data will need to be created to measure progress in the effort to transition from fossil fuels used for heating and transportation.

To learn more go to hanovernh.org.





Solar PV was installed on the roof of Hanover's town hall in June of 2019. (See p.12 www.bit.ly/GET-July-2019)

Jake and Susan Blum were among 65 residents who appreciated the chance to try out the UV E-Bike Library's electric pedal-assisted bicycles.

Nancy Serrell is a member of Sustainable Hanover where her focus is on reducing food waste. Rob Taylor is a member of the Sustainable Hanover Energy taskforce.

Rob Taylor is co-editor of the Sustainable Hanover newsletter and is leading the effort to upgrade the town's energy building code. ♻

Town of Hanover's Renewable Path

Closing in on 100% Renewable Energy

Robert Taylor and April Salas

In May 2017, Hanover residents endorsed a vision for achieving 100% renewable electricity by 2030, and heating and transportation by 2050. Town Manager Julia Griffin kept saying the town had to "walk the talk." The town is doing just that!

On December 28, 2020, Hanover flipped a switch on a solar array next to the water treatment plant and more than tripled its home-grown solar electricity production. And next summer, the total will more than double again. The result is the town will be providing about 92% of the electricity demands of its buildings and facilities with renewable energy generated right here in Hanover.

"This success is the culmination of years of hard work by Hanover's dedicated community volunteers, the Sustainable Hanover Committee, and Town Staff in Planning and Zoning, and Public Works," said April Salas, Hanover's inaugural Sustainability Director. "And we are very proud to lead the way," she added. Residents saw the town's first solar panels go up on the south facing roof of the police department back in 2015. Four years later, panels had been installed on the roofs of the town hall, equipment storage building, the salt storage building of the Public Works Department and on the Water Reclamation Facility. But the cumulative generating capacity of these added up to less than 300 kW DC, less than 15% percent of the town's power consumption. The town had a long way to go.

Help was on the way. Diligently, town staff and advisors had been working on a major advance. Using an agreement to purchase the power from an investor, the town had 1,872 solar panels erected on the grounds of the Grasse Roads Water Treatment Facility. When they were activated last December, they brought the town's solar power up to almost half of the energy needed to run the town's buildings and facilities, needs that had been boosted by the installation of heat pumps to heat and cool many of the town buildings instead of fossil fuel boilers. A second, even bigger phase of that Grasse Road solar farm is due to be completed this summer. When that goes on line, the town's solar panels are expected to power almost all of its electricity needs.

The first of two solar installation for Hanover, NH on Grasse Road. This 702kW installation is phase 1. Phase 2 community solar on this site will accommodate a 1021kW system. Image: Sustainable Hanover.

The Grasse Road project is a well-kept secret for much of the town's people. It stands on a little-used road out of sight of state route 10. The town has lots of other hurdles to clear before it meets its "Ready for 100" goals., but the Grasse Road project is a big leap forward.

Julia Griffin noted "Sustainable Hanover volunteers, the Select board and Town staff have been dogged in their determination to take the lead by showing the way. We have been joined by nearly 200 homeowners who have also installed solar or purchased panels in a NH community solar installation and Dartmouth College has also installed solar aggressively. This community is determined to make progress on the renewable energy front." ♻

The Foodscraps 360 Solution

Jessie Haas

A former graphic artist and current real estate appraiser in upstate New York, Diana Wright, found herself getting frustrated with the way the world was going, and ten years ago decided to adopt environmental protection as her cause. Working with People of Albany United for Safe Energy (PAUSE) she helped shut down fracked natural gas in NYS and the 'bomb trains' bringing Bakken crude into Albany. She was looking to retire, move to a cabin and grow vegetables, when an Albany-area composting project began to falter. The young woman running Foodscraps360 (FS360) was, as Diana puts it,"wearing all the hats," and burning out. So Wright bought the business and has been running hard ever since. Luckily, more people are stepping up to wear some of those hats, and prospects look bright.

Wright currently collects four tons of food scraps a month and composts them, producing what she calls 'black gold.' Courtesy image.

Project Drawdown has ranked 80 global warming solutions that are practical and scalable today. FS360 project impacts four of them: reduce food waste (#3), plant-rich diet (#4), landfill methane (#58), and composting (#60).

Food waste is associated with greenhouse gas emissions at every stage and reducing it has been the subject of multi-pronged efforts in the Northeast, including Zero Waste Capital District, a "volunteer coalition educating the public on sustainable waste management" which has run webinars and produced videos helping people change their food-buying habits. Zerowastecd.org encourages people to change their relationship to the objects in their lives. Rethink, refuse, reduce, reuse, repair, regift, repurpose, recover (that's composting), and finally, recycle.

The particular area of concern to Wright, and where her project has an impact on it, is in reducing or eliminating the production of landfill methane. Methane is a potent greenhouse gas, with thirty-four times the greenhouse effect of carbon dioxide; landfills are a prime source, emitting 12% of the world's methane. Foodscraps, yard waste, wood scraps, and paper produce this methane as they break down and are compacted and capped. Landfill methane can be tapped and purified to be used as a fuel, but it's far better to divert the organic materials to a better use—composting to grow more vegetables, thus making it easier and cheaper for people to eat a plant-rich diet.

FS360 was originally formed when a composting company called Empire Zero split in two, following the death of its founder, to focus on residential composting, though it also services schools, small food-service businesses and a local culinary institute. Wright currently collects four tons of food scraps a month and composts them, producing what she calls 'black gold,' nutrient-rich compost that area gardeners can use to grow more food. As one satisfied customer, Jan McCracken says, "I love composting because of the reciprocity. We take so much from the earth, and it's an opportunity to give back." Wright plans to add a phone app to her operation which will allow drivers to rapidly estimate how many pounds each customer contributes, and thus, how much CO2 they are helping to remove from the air.

Right now, FS360 operates out of Wright's driveway, basement, and porch. But she was recently able to buy three 25 by 75 foot adjacent lots in South Albany.

There, she will host six community gardens, and, working with the City of Albany, be the fourth foodscraps drop-off site for nearby local residents. Wright, a member of Zero Waste Capitol District, also plans to do a lot of education at the site, holding classes on building raised beds and different kinds of composting. In addition to the gardens, Wright plans to build a storage shed to house supplies for her business and the gardeners, as well as keep collected foodscraps from freezing in cold weather. The new site will also be a drop off for clean packing styrofoam (the kind that comes around a new television) and packing peanuts, which are being turned into insulation board by a small company in Cohoes, NY.

Wright and Tina Lieberman, founder of Zero Waste Capitol District, see this project as an opportunity for community building. Wright is currently fundraising to complete the South Albany facility. She needs to raise $18,000 to match the amount of her own money already invested in the project. "I'm not making any money," she says. "It's all volunteer. I'm just trying to do the right thing." Her GoFundMe page and Facebook page are being run by a friend, and fellow compost enthusiast. FS360 recently received a $1500 grant to help make raised beds and get the commnuity gardens going and is rewriting some other grant applications to reflect fresh energy and ambition as the team grows.

What does success look like? People calling about their institutions saying, "We're wasting food and I hate that. Getting into schools, reaching kids, who will reach their parents. No food scraps being thrown away, because everyone understands that there is no 'away.' Success is: no further need for landfills, because we have Zero waste." Sounds ambitious, but these organizations are making great progress. The mayor of Albany supports composting, and the municipality is starting a composting pilot project. Tina Lieberman is on the city's sustainability committee, and people are beginning to see that this will save them money. Albany was recently prepared to build a $30 million transfer station, which further catalysed activist support for composting and recycling.

People who are interested can connect with FS360 through its Facebook page to learn how to donate or volunteer.

Jessie Haas lives in an off-grid cabin in Westminster West, VT. She is the author of over 40 books for children and adults. volunteer.

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

The Refill Station Solution

George Harvey

Jessica Blasko is an experienced physical therapist who has had a lifelong love of nature and takes pleasure in traveling to beautiful places. She had an experience that started her thinking about doing things differently, however, when she and her husband went to a beach in Hawaii several years ago. There, they made the shocking discovery that much of what they saw in the sand was tiny pieces of plastic. That beautiful place was being choked with waste.

Customers bring their own containers to The Refill Station to buy cleaning and personal care products in bulk. Other eco-friendly products are offered all with the goal of minimizing waste. Photos: The Refill Station.

The issue came home to her even more when their family grew with the addition of two small children. Worried about their futures, the Blaskos decided to do something about the state of the planet. They became part of the Refill Movement, starting up the Refill Station in Portsmouth, New Hampshire. There, they provide people with a way to buy some of the things they need in bulk, filling their own containers, rather than taking them in throw-away plastic containers that add to the waste problem.

The Refill Movement has a fairly simple concept. Customers bring their own containers for bulk items, fill them, and pay for the amount they buy. Containers are reused, eliminating waste from the containers. Since the greatest amount of that waste is plastic, this reduces the plastic in our environment.

The bulk products include a number of cleaning products, such as laundry soap and dish detergent. There are personal care products, such as lotion and shampoo. A customer can buy hand sanitizer in bulk. Additionally, there are some dry products, including laundry powder and oxygen brightener.

There is a wide variety of other items on the shelves at the Refill Station. They are all chosen with care to make sure that they reduce waste, especially plastic waste. Among them jars and bottles, bags and brushes. There is toothpaste, and there are soap drainers. If you want a rack for drying clothes, the Refill Station is a place where you can choose from several designs.

Jessica Blasko points out that the Refill Station in Portsmouth is just one store in a movement. She mentioned a number of nearby stores. Two are in Kittery and South Portland, Maine. She mentioned one in Concord, New Hampshire, and another in Newburyport, Massachusetts. She noted other examples and said that she hopes Refill Stations will start up just about anywhere people go to shop.

Starting a business to sell to customers is not easy with a pandemic going on. There are special provisions to reduce risk of infection. A customer can drop off containers to be filled and do a curbside pickup later, for example. Products can also be delivered to customers, and this is free to places within seven miles, provided that the purchase comes to $20 or more. And products can be shipped.

Because of the pandemic, the store is only open three days each week. There is a hope that the pandemic will ease in the not-so-distant future, and the store will soon be open more often.

The website for the Refill Station in Portsmouth is worth a visit. It is at www.therefillstationnh.com. ♻

HIGHER PAYING JOBS for CLEAN ENERGY

Cont'd from p.1

Construction workers building a solar roof Wayne National Forest, Wikimedia Commons, www.bit.ly/2OvWWiE.

What we are seeing is a change in the fundamentals of energy. The cost of electric vehicles has been falling steadily and is expected soon to be at parity with ICE-powered vehicles, but the cost of operating them is so low that they already represent a long-term savings. Meanwhile, wind power and solar PVs are producing electricity at a fraction of the cost of what is needed to support coal and nuclear plants. Batteries are making renewable energy a more constant source of supply, and their electricity is cheaper than what comes from many natural gas plants. A news article in the November, 2020 issue of *Green Energy Times*, "Late News on Energy and Storage," has more on this (www.bit.ly/3eC34Ak).

The Energy Information Administration released a report in January stating that it expected only 16% of generating capacity added in 2021 will use fossil fuels, all of it burning natural gas. Solar would account for 31%, wind would provide 39%, and batteries would cover 11%. Of the remaining 3%, almost all would come from expected new nuclear capacity (www.bit.ly/3byVtRp).

Jobs should be created for mitigating damage from the fossil fuels industry. Abandoned coal mines and oil wells need to be secured and closed, a job often best done by people who had worked in those industries. Estimates are that there are 300,000 to 760,000 uncapped oil wells in Pennsylvania alone, and that this represents only about 15% of the country's abandoned wells, according to a report in the Observer-Reporter, a newspaper in that state (www.bit.ly/38EkZT6).

At the same time, jobs are to be created for work in renewable energy. The push for growth in renewable energy comes for many important reasons. Climate change is a very important issue. Also, the economics of renewable energy would have it crowding fossil fuels out of the economy even without a climate crisis. And, of course, we have to recover from Covid-19, offering jobs to a large number of people who are unemployed.

The change in the way our energy is produced will mean hiring a lot of people, and our new Energy Secretary, Jennifer Granholm, has a bit to say about that. CNN ran an article titled, "Biden's energy secretary vows to 'leave no worker behind' in the clean energy revolution" (www.cnn.it/3eBPYmy). This new administration has a stated intention of seeing to it that the people and communities that might suffer from the fall of fossil fuels will have jobs and opportunities as we go forward.

This, of course, brings up the issue of how good those jobs will be. A report from E2 (Environmental Entrepreneurs) goes into this in some depth (www.bit.ly/3cs9ZcQ). It shows that employment in the country's renewable energy industry pays significantly more than median rates.

How many jobs will be created remains to be seen. With forces of government policy, the market, and public sentiment all favoring them, we can bet there will be a lot. ♻

Clean Energy Investments

– Cont'd from p.1

total electrical generation, even though that was an all-time high.[3]

- **No longer based on government incentives.** For years, the main driver of renewable energy was government incentives, which were necessary to justify the outlay. However, with costs coming down so dramatically, renewables can now break out on their own, free of the fear of incentive repeals.
- **Biden and worldwide net-zero pledges.** Meanwhile, the re-engagement by the U.S. in climate reversal, including re-entering the Paris Climate Agreement, means massive investment in clean energy infrastructure by governments and corporations at home and abroad, as they race to meet their pledges of a net-zero future.
- **Mega installations.** While home and small business renewable systems are still important to the growth of the industry, the increasing trend toward mammoth solar, wind, and tidal installations is taking clean energy to the next, utility-scale level. In fact, many traditional utilities are now adding their money to this super-system boom as well.
- **Stepped up innovation.** The sea change to renewables is generating unprecedented new sums for research and development, accelerating innovation. Every day it seems there is a new idea, from green hydrogen and fuel cells to grid-wide battery storage, energy blockchains to tidal energy, biogas to floating solar, all of which offer even more investment opportunities.
- **Third world leap-frogging.** The new ability of third world countries to use renewable energy to skip the construction of original or replacement fossil fuel power plants opens up a vast new horizon of installation and investment.

Utility-scale solar photovoltaic farm in Sacramento, CA. Photo Sarah Swenty from USFWS/Wikipedia Commons.

Diversify, Diversify – It's Easier than Ever

For all these reasons and many more, we believe the industry's time in the sun is here to stay. But that doesn't change some fundamental rules of investment. Most importantly, do not concentrate your money too much in any one place -- including green energy -- or in just a few companies in this sector. Fortunately, there are more mutual and exchange-traded funds in this area than ever to help spread your clean energy investments among scores of promising companies with just a few purchases. Some of the best-known include (using market symbols to save space): **QCLN, PBW, SMOG, TAN, FAN, CGAEX, GRID, NALFX, PZD, PBD, ICLN.**

Dump the Risk of Fossil Fuel Investments at the Same Time

Finally, do your portfolio another favor as you pursue clean energy investments: unload securities with exposure to fossil fuels. These are increasingly dead-end as they lose the price advantage to renewables and face increasing government regulation and loss of subsidies. Coal was the first to go essentially bankrupt; the rest are already wobbling. Eliminate future risk to your portfolio now and make the switch to the much brighter clean-energy wave.

[1]Morningstar. Past performance is no guarantee of future results.

[2]CNBC 12-27-2020, "Renewable energy stocks had a record year – here's what Wall Street sees for 2021".

[3]U.S. Energy Information Administration (EIA), Feb. 2021.

Todd and Craig Walker are financial advisors at Greenvest, a Vermont-based personal asset management firm specializing in clean energy and socially responsible investing since 2004, and a B Corporation www.greenvest.eco.

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8 Cool Solar-Powered Camping Gears for Green Adventure

Harsh Paul

Harnessing the power of the sun on your outdoor adventure makes all kinds of sense. The uses of solar energy have grown and camping gear is no exception to these benefits. Making use of solar energy isn't all about creature comforts. It is also a beneficial solution for safety and connectivity. Let's look at eight coolest options available for your solar-powered camping gear.


Flickr/jluster

1. Solar Lantern

Lighting is an essential requirement for camping. Campers should have a flashlight and a lantern. It is best to use LEDs for both these applications. You could use traditional battery-powered lighting solutions or maybe even the older fuel-powered lanterns.

However, the most convenient solution in both cases is solar power. With the sun shining, you never have to worry about carrying replacement batteries or extra fuel. Sunlight handles all those requirements and you have dependable lighting available for your needs.

Several products are available for both these requirements. While campers must consider a solar lantern, having a solar flashlight along can be very useful too.

2. Solar Shower

Hygiene doesn't have to take a break just because you're outdoors! It is not unheard of for campers and hikers going to remote locations having trouble finding suitable bathing options. Carrying along a solar-powered shower can take away a big chunk of those problems. A camping shower is worth considering for car campers as well.

These are generally passive solar products that heat up water by absorbing radiation from the sun. You won't get piping hot water, but it will be comfortably warm for a shower. A portable shower is an excellent option for trips where hygiene can become an issue.

3. Solar Charger Backpack

It's very likely that you're carrying a backpack to your vacation, why not get more use from it? Some backpacks include batteries that can be used for charging devices later. Others prefer a direct charge. These backpacks can be very useful in keeping gadgets like your mobile phone powered and juiced up.

Besides, the backpack of any hiker or camper is going to see a lot of sun throughout the day. Whether you choose to hike or just chill by the tent, the backpack can be exposed to sunlight. Might as well get a solar powered backpack and put solar power to good use!

4. Portable Solar Generator

Gadgets like the EnergyBar or Portable Solar Generator work with a higher power density than conventional solar batteries or power banks. These devices will certainly charge your mobile phone or similar gadgets. However, they have enough juice to power larger devices as well. The EnergyBar, for example, is capable of running an LED TV for 10 hours.

These gadgets can afford a high-power output and can be used for 110V AC power output as well. Given their backup, they form excellent and very reliable power sources. The overall setup can be a bit clunky because you'll need a fairly powerful solar panel as well. Alternatively, just use solar power at home to charge up these gadgets, and enjoy the backup while out camping.

5. Solar Power Water Purifier

Getting access to clean, potable water can be challenging for many camping destinations. There is always a chance that even the clear stream running in the wilderness harbors pathogens. A solar power water purifier takes away most of the worries on that count.

Using the sun to power a tiny water purification system to ensure you have potable water is convenient and desirable. A lightweight, portable kit that's easy to carry along can be very beneficial.

6. Solar Battery Charger

This option is more like using a conventional power bank, except the power comes from the sun. Having the sun charge a power bank means you'll always have juice for necessary devices.

Keeping the mobile phone running is an obvious use. However, it's as useful for other communication devices like walkie-talkies

Cont'd on p.21

Restore Our Earth™ • Earth Day 2021

While every day is Earth Day at *Green Energy Times,* we are always happy to see the renewed focus come as April 22nd is approached every year. The first Earth Day happened on that date in 1970. In April, we see schools, communities, and businesses celebrate in their own ways to help protect our planet. The original Earth Day was viewed as a teach-in at schools. It quickly grew to more than that (see http://www.greenenergytimes.org/2020/04/02/earth-day-2/).

Earth Day's 2021 theme, Restore Our Earth, focuses on natural processes, emerging green technologies, and innovative thinking that can restore the world's ecosystems. This year, three full days of climate action events are planned.

Beginning on April 20, the global youth climate summit led in partnership with Earth Uprising, will consist of panels, speeches, discussions, and special messages with today's youth climate activists including Greta Thunberg, Alexandria Villaseñor, and Licypriya Kangujam. The four-hour digital summit will address the progress that has been made on their main issues of concern, including the creation of green jobs, climate literacy, civic skill training, environmental justice, biodiversity protection and sustainable agriculture.

In the evening on April 20, the Hip Hop Caucus and its partners will present the "We Shall Breathe" virtual summit. This digital event will examine climate and environmental justice, connecting the climate crisis to issues of pollution, poverty, police brutality, and the pandemic, all within a racial justice framework.

On April 21, Education International will lead the "Teach for the Planet: Global Education Summit." The multilingual virtual summit will span several time zones and feature prominent activists from every continent, focused on the crucial role that educators play in combating climate change and why we need transformative climate education now.

Parallel to the Biden Administration's global climate summit, EARTHDAY.ORG will produce its second Earth Day Live digital event on April 22. The multi-hour multi-channel livestream will include segments taking place around the world starting at noon Eastern Time. Workshops, panel discussions, and special performances will focus on Earth Day's 2021 theme, Restore Our Earth. Topics will include climate and environmental literacy, climate restoration technologies, reforestation efforts, regenerative agriculture, equity and environmental justice, citizen science, clean-ups, and beyond. World climate leaders, grassroots activists, nonprofit innovators, thought leaders, industry leaders, artists, musicians, influencers, and more will be involved.

More information will become available in the coming weeks at https://www.earthday.org/earth-day-2021/. ♻

Camping Gear – Cont'd from p.20

and ham radios. For many popular camping locations, walkie talkies and radios are far superior options compared to mobile phones.

The solar battery charger does not have to be an overly hefty system. You can use one that's a small solar panel on the back of a power bank. Those who want to draw more power from the sun can use a more complex and heavier solar panel charger setup.

7. Solar Cooker

As the name implies, a solar cooker or solar oven uses the power of the sun to cook food. It's quite a simple and elegant solution to cooking needs. It's also cleaner and more environmentally friendly than burning wood to cook.

A plausible downside is that these cookers take way longer to prepare food as compared to cooking on a fire. Remember to start early and be patient. Though these options take longer, the quality of cooking and food is not affected negatively.

8. Solar Multi-Tool Kit

Putting several solar tools and operations in one system seems like the natural order to pursue. The solar multi-tool kit puts together some necessities for your camping gear. While the exact configuration can vary depending on the kit you choose, any kit will include a solar panel and a power storage bank.

This can be used to power up gadgets like the mobile phone or GPS. Some kits also include a flashlight and a small fan, both of which can come in pretty handy on camping trips.

Harsh Paul is the editor of DeepBlueMountain, a website dedicated to camping resources, tips, and reviews ♻

Green Up Day Vermont 2021

Fifty-one Years and the Green Goes On

G.E.T. Staff

Started in 1970 by Governor Deane C. Davis, Green Up Vermont is a non-profit organization whose mission is to promote the stewardship of the state's natural landscape and waterways and raise public awareness about a litter-free environment, culminating with a statewide clean-up event called Green Up Day. Always the first Saturday in May, Green Up Day is a statewide initiative where volunteers clean up litter from roadsides and waterways. Green Up Vermont also offers an educational component for grades K-12 with free activity booklets and other materials and activities that build their civic engagement and pride for clean environments.

In 2020, Vermonters were unwilling to let go of the 50-year-old springtime tradition that spruces up communities, even during a global pandemic. It wasn't the same Green Up Day with community celebrations and barbeques, but volunteers throughout Vermont wanted to do their part for their environment. Nearly 14,000 volunteers from 244 towns used innovation and ingenuity to get the job of cleaning over 241 tons of trash and 9,000 tires from the roads. The Green Scuba Team was formed for the first-time last year to clean the depths of Lake Champlain.

Now it's a new spring and excitement is already growing for Green Up Day 2021, which will be held on May 1st with all safety protocols in place.

A big part of Green Up Day is the art contest. There were record numbers of submissions from students all over Vermont. The 2021 overall poster art winner is Jiya Sekar, a third grader from Union Elementary in Montpelier. Her art will be used on the poster and marketing materials promoting the 51st Green Up Day. Her artwork completely captures a happy and clean landscape that inspires us to keep Greening Up.

In addition to the long-standing poster art and writing contests, Green Up has expanded to offer a jingle contest, a video contest, and a graphic arts contest to reach an array of talent in our youth and get more students to participate on Green Up Day and in community volunteerism. Kate Alberghini, Executive Director of Green Up Vermont said, "We love encouraging our youth to get involved, and we can't wait to share the winners of the other categories! There are some really talented kids here in Vermont, focusing on sending some really great messages about the importance of Green Up Day."

Two other initiatives are being implemented this year. One is the Green Up Vermont Mentor program where high school students are paired with volunteer town coordinators in leadership roles to help produce Green Up Day in their towns. The second initiative is the Green Up Vermont Stewardship Partner Program where the Green Up Vermont organization helps various entities like parks, towns and individuals rally volunteers for special pick-up programs year-round as well as a Fall Green Up 2.0.

To learn about the contests, how to get involved with Green Up Vermont, or make a donation, go to www.greenupvermont.org. Green Up supplies will be distributed to towns in early April. Be sure to mark your calendars for the 51st Green Up Day on May 1st. ♻

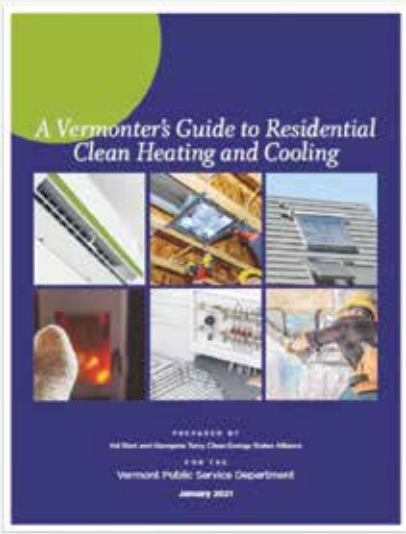
Above: The winning poster for the 2021 Green Up Day was created by Jiya Sekar, a third grader from Union Elementary in Montpelier. Courtesy photo. Center left: The Green Scuba team cleaned up Lake Champlain. The team pulled out a chair, bicycle and five Green Up bags of trash. Photo by Kate Alberghini. Below: Volunteers in Barre Kids hand out trash collection bags during the 2020 Green Up Day event. Courtesy image: Guin Fredriksen.

Heating and Cooling Your Home

CLEAN TECHNOLOGIES DEMYSTIFIED

By Georgena Terry

The Clean Energy States Alliance (CESA) recently released a new guide to heating and cooling, prepared for the Vermont Public Service Department. If you need to replace your home's existing central heat or hot water system, are looking for additional space heat, need whole-home or space cooling, or if you're building a new home, now is the perfect time to invest in a clean, reliable technology. A Vermonter's Guide to Residential Clean Heating and Cooling is an excellent first step to understanding what clean heating and cooling (CH&C) technologies are, how they work in a home, and where to find incentives and financing.



Vermont is a national leader in energy efficiency. The state's 2015 Renewable Energy Standard increased the amount of renewables utilities must procure from 55% in 2017 to 75% by 2032. Vermont is well on its way to meeting these targets. the Burlington Electric Coop is already operating on 100% renewable electricity and the state's electric power supply is 67% renewable.

In addition to its renewable energy goals, Vermont also has greenhouse gas (GHG) emissions reduction targets, set by the 2016 Comprehensive Energy Plan. These targets include a 40% reduction by 2030 and an 80 to 90% reduction by 2050 in 1990's GHG levels.

To meet both Vermont's renewable energy and GHG emissions reduction goals, Vermont needs to address how we heat and cool our homes and buildings. Vermonters spend an average of 25% of their household energy budget on heating costs. Vermonters heat their homes primarily with fossil fuels, and so the thermal sector is the second largest GHG emissions contributor in the state (after the transportation sector. This accounts for nearly 24% of Vermont's GHG emissions. Furthermore, Vermonters spent over $650 million on imported fossil fuels (in 2017) for residential heating; nearly 70% of each dollar spent on fossil fuel heating leaves the state.

A Vermonter's Guide to Residential Clean Heating and Cooling informs Vermont homeowners about ways to reduce fossil fuel use, improve home comfort, minimize health risks, and reduce indoor and outdoor air pollutants with CH&C technologies. The guide covers a variety of information to help homeowners understand the advantages of energy efficiency, the benefits of clean heating and cooling technologies, the differences among those technologies, how to choose a contractor, and how to access state incentives and financing.

The technologies reviewed in the guide include advanced wood heating, wood pellet furnaces, wood pellet stoves, ground source heat pumps, cold climate air source heat pumps, heat pump water heaters, and solar hot water. Clean heating and cooling technologies such as ground source heat pumps and advanced wood pellet boilers can supply hot water in addition to space heating and cooling. Heat pump water heaters and solar water heaters provide hot water only. The guide stresses home energy efficiency improvements as the first step to improving a home's energy performance, cleaner indoor air, improved home comfort, and energy savings.

There are multiple benefits associated with clean heating and cooling technologies. Health benefits include less hypertension and heart disease and lowered pulmonary, heart disease, and cancer risks. On the environment and economic side, CH&C technologies reduce fossil fuel consumption and carbon emissions while boosting investment in renewable energy and energy efficient technologies. They can lower heating costs and contribute to energy resilience and sustainability. And CH&C technologies support the local economy, especially the forest products industry.

Understanding the home's heating needs, its current distribution system, its insulation, and compatible CH&C technologies is complicated. For this reason, it is imperative that consumers consider working with qualified contractors and installers who can guide them through the process of choosing and installing a CH&C system. A Vermonter's Guide to Residential Clean Heating and Cooling helps consumers with the process of selecting a contractor and maintaining a CH&C system through clear recommendations for each type of equipment.

The Guide also includes a checklist to help consumers successfully install a clean heating and cooling project. Topics include preliminary steps, purchasing and contracting, pre-installation, and incentives and financing as well as specific considerations for cold climate heat pumps, ground source heat pumps, and advanced wood heating.

Purchasing a heating and cooling system of any kind can be expensive. But switching to a CH&C system can be a cost-effective solution in the right situation. Various rebates, loans, and incentives available for CH&C technologies help reduce the upfront costs of installing a CH&C system. The Guide describes these as well as low-interest public and private financing options and tax and federal incentives.

If you are looking to replace your home heating system, need supplemental heat, or building a new home, check out the Guide at this link: www.bit.ly/VT-Guide-Residential-Clean-Heating-Cooling. More resources are available at the Vermont Renewable Resource Center, http://www.rerc-vt.org/.

Georgena Terry is a research associate at Clean Energy States Alliance. ♻

Campton, NH School Energy Upgrade

George Harvey

The Campton Elementary School in Campton, New Hampshire. Courtesy photo: Froling Energy.

In 2017, *Green Energy Times* ran an article, "Plymouth New Hampshire Regional High School Energy Efficiency Upgrades," describing work done by Energy Efficient Investments (EEI) for New Hampshire's School Administrative Unit 48 (SAU 48) to upgrade energy systems for Plymouth High School (www.bit.ly/Plymouth-upgrades).

Since that time, the promised new levels of efficiency of the new system have been achieved, providing the school system with some impressive savings. Prior to that upgrade, about 60,000 gallons of oil were burned for heat each year, and the replacement system is much less expensive to run. The electricity used for lights has also been reduced by 35% by installing LEDs.

Plymouth High School is just one of the eight schools SAU 48 is responsible for. The other schools are all for younger students. All of those schools also need heating and lighting upgrades from time to time. Projects are awarded to the companies whose work gives taxpayers the best value, and when it came time to upgrade the energy system for the Campton Elementary School (CES), EEI had the advantage of having a proven record.

EEI is not simply a sales and installation company. It goes beyond that. Starting with energy audits, it can guide a customer through the many steps to energy improvements. Depending on what is needed, EEI does part of the work itself, or it helps find someone who can do it. Some of the many things EEI does include analysis of existing needs and future costs, design to implement the most cost-effective systems possible, helping to find funding, helping on grant applications, and finding tax incentives.

CES used 18,000 gallons of oil each year for heat. The oil was burned in a heating system that was well past its prime and was badly in need of replacement. There were other common problems of efficiency and energy at the school, such as replacing lighting with LEDs.

There was also one big problem that seemed to be irrelevant to questions of energy. It was a large storage shed used for lawn equipment that was in dire need of replacement. The shed was in a perfect spot for a new outdoor furnace. And so, it became part of the energy upgrade for the school.

Over the summer of 2020, EEI managed to get work done on the extensive change-over, during the time it was normally out of use. The old boiler was removed. So was the old shed. A new shed was built, with room for the new wood-chip fired boiler on its lower level. A silo for the wood chips was installed.

The new biomass boiler was built by Schmid, a company based in Switzerland. It was installed by Froling Energy of Keene, New Hampshire. This is the same Froling Energy that is well known to GET readers, as it has been central to multiple articles, including "Benefits to the Planet Heating with Forest Products," which appeared in our September 2020 issue (www.bit.ly/forest-biomass). Froling is not only the installer, however, as it will have continued connection to the school by servicing the boilers and supplying wood chips.

The upgrades at CES included more than heat, of course. The lighting system was changed over to LEDs controlled by use of Philips SpaceWise technology. The SpaceWise control system is wireless making it possible to have sophisticated smart lighting without the cost of wired installation. The lights can be controlled in zones, such as classrooms, with equipment that senses a range of things from the presence of people to the amount of daylight.

The people at EEI like to make the upgrades pay for themselves. Mike Davey, EEI's Business Development Manager said, "We try to help the energy savings pay for the work. Typically, the project is cost-neutral."

The savings should cover the cost of the new equipment and installation. In the case of the Campton Elementary School, EEI helped get grant funding from the New Hampshire Public Utilities Commission, reducing costs. Ultimately, the cost of the energy portion of the upgrades was sufficiently well covered to be cost-neutral, and the only bit not covered in that is the cost of the new shed, which was needed, but not part of the energy and efficiency project. ♻

Inset: the new shed and silo; above is the new biomass boiler. Photos courtesy of EEI.

Biomass Good for NH – *Cont'd from p. 15*

New Hampshire forest. Giorgio Cantoni, Unsplash. www.bit.ly/3195Syr

visible smoke. The boilers are even self-cleaning! The wood pellets used are made from 100% wood, from sources around the state, and made at local sawmills. The wood used is from sawmill waste and sustainable forestry practices. No glue or additives are used, and the pellets are stuck together using the lignin that makes up the wood to bind them together.

In addition to the new ITC, New Hampshire has a rebate program for bulk-fed wood pellet central boilers and furnaces. The program provides a rebate of up to 40% of the system and installation cost for residents investing in high efficiency (80% or better) systems. To learn more about modern wood heating technology, local installers, resident stories, and available incentives, please visit www.feelgood-heat.org and get started on your journey to modern wood heating.

Josh is the Program Coordinator at Clean Energy New Hampshire, where he plans, develops and delivers technical and educational assistance to communities around the state. Josh has a Master's degree in Environmental Law and Policy from Vermont Law School.

Note from the editor: *The biomass topic can be controversial. We will attempt to clarify any concerns regarding the use of biomass in the next edition of* Green Energy Times. ♻

Wright Construction Builds with Award-Winning Techniques

For a Post and Beam Home Addition in Ludlow, Vermont

George Harvey

Readers may remember that we have had articles in the past about Wright Construction Company, in Mount Holly, Vermont. The most recent appeared in June of 2018, and it addressed issues many builders never talk about. It was "Rebuilding After a Disaster," and it went beyond ordinary construction problems and energy efficiency, and even beyond financial issues, to look at the emotions of loss and the attempt to recover. A story like that can stick in a person's mind.

Above: The post and beam award-winning addition for this home in Ludlow, Vermont is nearly finished in this photo. Inset is of the main living area. Photos courtesy of Wright Construction Co.

Recently, Wright Construction came up again, as we got wind of the fact that the company had won a bronze award in the Qualified Remodeler Magazine's 2020 Master Design Awards for the "Addition Over $250,000" category. This is a nation-wide competition held by a respected publication, and the award is definitely important.

The project that won Wright Construction the award was a large addition of 7,500 square feet to a house in Ludlow, Vermont. It is just over half of the finished structure, which originally had 6,500 square feet of space.

For those who might gasp at the idea of a 14,000 square foot house, we should mention that this is not a private home for any one family unit. Rather, it is designed as a place where a large, extended family of over 40 people can gather, all at once.

The home-owners had their preferences about what it would look like and how it would function. The job that Wright Construction did was to turn their vision into reality. It was a project, however, that included more than just attention to the details of a floor plan and where to buy materials. It included some regard for the graceful beauty of the house and the comfort of the people who gather there. And it included attention to the value of the property and the efficiency of the building.

One thing the customers wanted was to have the addition built with post and beam design, which adds to the cost of construction. Ordinarily, many builders might put insulation into the open areas between posts and beams as infill, but this approach misses an opportunity to get some real efficiency. The thermal bridges and possibilities for air leakage in such a structure can be avoided by covering the entire exterior with SIPs, or structural insulated panels and sealing them well. The beauty of post and beam construction is enhanced by having it fully visible inside the building.

Carl Lavallee, the COO of Wright Construction, told us, "It has a timeless look, and it is a

Cont'd on p.27

The Ways of the Earth

Dr. Alan K. Betts

There are fundamental truths about the Earth system that we must face in the next few years. The webs of deception from the last few years are receding, so we can now confront issues that have been invisible for a long time. Much of our human world is now driven by science and technology. Science is a good frame for understanding our technological world, as well as the complexity of the living natural world. However, science is not useful for addressing social values and making moral choices.

In this void, choices are made implicitly by our (Western) society's guiding economic frame which is capitalism. New things are invented and if they can be marketed profitably, they are introduced with little control. The goal of capitalism is to increase short-term profits within a consumer growth economy. Growth is driven by advertising and by exploiting the Earth's resources as well as people, especially the poor.

Immense wealth has been created for some, and the human population has increased until our global impact exceeds the Earth's carrying capacity. Now climate and extinction crises are rapidly approaching, simply because much of our economic system is not designed to pay for future costs, especially the damaging consequences of our vast waste streams.

Consider instead the *Blue River Declaration* from October 2011.

"A truly adaptive civilization will align its ethics with the ways of the Earth. A civilization that ignores the deep constraints of its world will find itself in exactly the situation we face now, on the threshold of making the planet inhospitable to humankind and other species. The questions of our time are thus: What is our best current understanding of the nature of the world? What does that understanding tell us about how we might create a concordance between ecological and moral principles, and thus imagine an ethic that is of, rather than against, the Earth?

"In our time, science, religious traditions, Earth's many cultures, and artistic insights are all converging on a shared understanding of the nature of the world: The Earth is our home. It will always be our only source of shelter, sustenance, and inspiration. There is no other place for us to go. It follows that the world is worthy of reverence, awe, and care."

Clearly, ten years later, U.S. society has not made this transition to align its ethics with the ways of the Earth. The recent change in the federal administration will not fix our poor social and economic understanding of the living natural world. I suggest readers view the sincere efforts to address climate change by the Biden Administration through° the clear lens of the Blue River Declaration, a statement of environmental ethics put forward by the Blue River Quorum.

This means facing a deeper issue. Even though we are embedded in the biosphere, very few people understand this intellectually, let alone intuitively. Reconnecting deeply with the natural world means surrendering to it, so you feel part of it on an emotional and heartfelt level. Indigenous peoples and the founder of Christianity understood this. But the concept of surrender is horrifying to 'modern' humans, because of our devotion to human power and control, and our memories of many centuries of warfare.

The Earth is our common home. Image: onecommunityglobal.org

We have two critical tasks in this coming decade. One is to slow climate change by reducing the global atmospheric carbon budget to net-zero, which means to stop burning fossil fuels. This is turn means focusing on improving energy efficiency and implementing renewable energy resources on a much larger scale than we do currently to replace the fossil fuels. The technologies to do this have become relatively inexpensive – far cheaper than the costs of the climate disasters ahead, if we do not make this transition. The only big obstacle -- which has been with us for decades -- is that the fossil fuel companies and their associates are heavily invested in deceiving the public and using politicians to protect their profits as long as possible. Their recent strategy has been to reframe the issues to pretend that climate change can be solved by individuals changing their choices and behaviors, so that direct legislative mandates can be avoided.

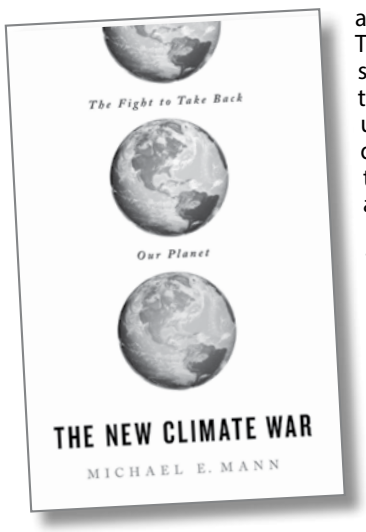
The second difficult task is to see that the human destruction of so much of the natural world is driving many species to extinction and replace destruction with reverence. Neither task is easy, so we all have to plan ahead. Spring is arriving and, if we look more deeply, the Earth can help.

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

Book Review:
THE NEW CLIMATE WAR *– The Fight to Take Back Our Planet*

by Michael E. Mann, published by PublicAffairs (2021), 368 pages, $29

Review by Roger Lohr



The book The New Climate War: The Fight to Take Back Our Planet by Michael E. Mann was released during the early months of the pandemic in 2020 by PublicAffairs books. In a story about efforts by what the author refers to as "inactivists" (previously known as climate-change deniers) to thwart any significant change, there are many references to the pandemic and to analogies in other segments of the political action spectrum.

Mann is a professor of atmospheric science at Penn State and author of five books, with joint appointments in the Department of Geosciences and the Earth and Environmental Systems Institute. In 2019 he received the Tyler Prize for Environmental Achievement, often called the Nobel Prize for the Environment.

The Climate War has a historical review of the strategies used to defer and prevent addressing climate change. This type of "undertaking" started with the internal Exxon documents in which a scientist admitted the measurable and nonreversible outcomes associated with fossil fuels, and resulted in robust public relations campaigns incorporating science deniers-for-hire, and more.

The culprits in the war are the fossil fuel companies, right-wing plutocrats, and oil-funded governments who have shifted from outright science denial to softer strategies based on deception and distraction. Free-market fundamentalists (individuals and corporations) obscure public understanding with misinformation and misdirection. They discredit the scientific message, attack the messengers, undermine facts, deflect blame, divide the public, delay action, promote alternative solutions that don't actually solve problems, and insist that we simply accept our fate. Mann attaches names and dates to an avalanche of inactivists and their activities – both on the right and left of the political spectrum from claims of denial to warnings of the Earth's extinction.

Mann presents examples of the techniques used outside of climate change such as the battle against the DDT ban, the Crying Indian TV ad that was created by Keep America Beautiful (Coke, Pepsi, Anne Heuser Busch, etc. with the Sierra Club and Audubon Society as original program partners) as a way to defeat bottle-return legislation, and the cigarette industry's joint campaign with the chemical industry that blamed flammable furniture for cigarette-induced house fires. The fire-retardant campaign even bought off firefighting organizations for support! And speaking about fire, last year President Trump deceptively insisted the California forest fires were promulgated by poor forest management rather than climate change and drought.

Techniques to combat meaningful action on the climate crisis attack and divide individual action, responsibility, and broader government policy for systematic change. Mann feels that the needed tipping point will only happen when there is active participation of citizens everywhere aiding in the collective push forward, but he realizes that individual action (from turning off lights to installing solar panels on your roof) while necessary, can only get us so far to tackle the climate crisis. The reduction in travel and commerce during the pandemic shutdown reduced global emissions by only 4%. Systemic changes are far more critical to carbon emission reduction. According to Mann, applying broad-based technology is required. High-speed railways, research and development for renewables and battery storage, and developing programs to reduce CO_2 must be done on the macro level. Inter-governmental agreements with enforcement of domestic energy and climate policies that incentivize the shift are necessary.

There is also division among and against the community that wants to address climate change as the politics of identity, behavior shaming, and virtue signaling are used. Some of this action is instigated by inactivists using social media similar to the Russian intervention in the 2016 U.S. election. Personal carbon footprints are a regular weapon that are used, whereby individuals are pegged as hypocrites if they eat meat, fly in airplanes, or have children. The threat of mandated personal sacrifice is an easy way to mobilize people to oppose change. These techniques are to prevent climate advocates from effectively speaking with a united voice and erode support for systematic solutions to the climate crisis.

Currently there are progressives in favor of societal transformation and opposed to carbon pricing schemes because the plans seem politically unattainable, unworkable, and unjust to economically disadvantaged people. Progressive leader Naomi Klein's view is that environmental sustainability is not compatible with a neoliberal political framework built on market economics. Can the government that spends $30 million to develop a healthcare website that does not work, takes months to mail stimulus checks, or struggles to coordinate a vaccination program be expected to develop and maintain a carbon pricing tax redistribution program?

Michael E. Mann

Mann feels that we have to disregard the doomsayers (those who state that it is too late to fix climate change), look to the young leadership; educate the populace and engage in systematic change (remove the politicians who oppose changes needed), and consider corporate culpability to bring about momentum to address climate change. Can it be done in your lifetime?

Roger Lohr of Lebanon, NH, who owns and edits XCSkiResorts.com, has published articles and promotional topics on snow sports, sustainability, and trails in regional and national media. He is also the Recreational Editor for Green Energy Times. ♻

Cash for Your Refrigerants – Help for the Planet

Jessie Haas

According to Project Drawdown®, refrigerant management is the single most effective solution to global warming. Founder Paul Hawken has lamented that the math led his team to such an uncharismatic solution. It doesn't lend itself to posters and memes the way a baby polar bear does.

But the math is the math. Drawdown estimates that refrigerant management, done right, will result in a total atmospheric CO2-equivalent reduction of 89.74 gigatons. The problem is largely being addressed under the Kigali Amendment to the Montreal Protocol, the highly successful international treaty created to address the hole in the ozone created by an earlier generation of refrigerants. The Montreal Protocol banned the production of ozone-depleting substances – old refrigerants 10,900 times as potent as carbon dioxide. The Kigali Amendment expands the Montreal Protocol to phase down HFCs, the replacement refrigerants that are also potent greenhouse gases.

Tradewater expanded their work globally in 2019 through a partnership with City Waste Recycling that resulted in the collection of 29,140 lbs. of refrigerants in Ghana. City Waste Recycling employees prepared stockpiled cylinders of CFCs for transport to a destruction facility in the United States where it was destroyed preventing the release of more than 136,000 tons of carbon dioxide emissions. Photo: Tradewater.

The Kigali Amendment, signed in 2016, began phasing out HFCs in developed countries in 2019; poorer countries will follow suit over the next few years. The Kigali Amendment was not ratified in the U.S. during the Trump Administration, but Congress and the Biden Administration have recently taken action to make it effectively the law of the land, with the strong support of the refrigerant trade group.

A problem remains, however. All over the world, discarded appliances and banks of refrigerant gas await, ready to leak into the atmosphere, sometimes actively being bled off before a car or appliance is discarded. These remain a potent threat to our ability to rein in global warming.

One company (though it looks like two) is working to solve that problem. Tradewater takes a two-pronged approach. Its Refrigerant Finders branch offers cash for people's old refrigerant. In some cases, they'll come pick it up, otherwise you can mail it to them and receive payment. Refrigerant Finders doesn't talk about global warming on its website. Founders Tim Brown and Gabe Plotkin know that some people don't believe in it, and they aren't interested in having the argument; they'd rather get the gas. Once they've collected it, it's incinerated in a permitted hazardous waste rotary kiln incinerator which eliminates 99% of the global warming potential. Since 2012 Refrigerant Finders has neutralized between 150,000 and 250,000 pounds of refrigerant a year, mostly in small cylinders and cans. This fact is expressed on Tradewater's website, "Since 2012 the company has destroyed 4,660,000 tons of CO2 equivalent, or 789,000 houses powered for a year, 5.24 million gallons of gas used, 11.5 billion miles driven, or 10.8 million barrels of oil consumed."

Tradewater's website does talk about global warming, offers calculators so visitors can estimate the amount of greenhouse gases (GHGs) you emit as a household, for travel, or for a specific event, and sells carbon to support its work. Most of the funding for this for-profit company, however, comes from working through the California cap-and-trade system. Companies that want to emit more than their permitted amount of CO2 need to buy carbon offsets. Tradewater is one place they can get them.

Tradewater's work has mostly been in the United States to date, (they have collected gas from every state except Alaska) and there is more to do. Brown says, "(t)he more we look, the more we find. So, there's a lot of it out there still."

But the company has begun to work outside the United States as well. In Ghana, officials discovered a large bank of refrigerant canisters that had no further economic use—appliances no longer use it—and no safe destination, as there was no disposal facility in the region. Tradewater ran an experiment, taking the offsets onto the open market and were able to fund the project with help from Intuit, known for TurboTax and QuickBooks. The whole project averted the equivalent of a year's emissions from 27,601 cars.

In 2020, Tradewater International was formed to scale its search for refrigerants around the world. It is based in Costa Rica. Tradewater is now involved in a project in Latin America called RefriCazadores where they have identified stockpiles of gas and are in the process of hiring workers to collect and destroy them. Recently, a project in the Dominican Republic has been completed, and Tidewater is actively working to develop projects in over fifteen countries in Latin America, the Caribbean, Africa and Asia.

Tradewater offsets were identified as one of the best bangs for the buck by GivingGreen, an organization that rates environmental charities. GivingGreen notes some lack of transparency in this for-profit company but says, "Over all we believe that the offsets offered by Tradewater are highly credible and that purchasing Tradewater offsets has a direct link to decreasing the amount of GHGs in the atmosphere." Tradewater's credits are verified by the American Carbon Registry (ACR) and Verra. Verra's verification process accounts for the carbon footprint of obtaining and transporting the gas.

People with gas to dispose of can go on the Refrigerant Finders website to learn more about how to dispose of it and get paid. There is a process for weighing gas and subtracting the weight of the canisters. Customers will then be sent a shipping box. People wanting to buy offsets should visit Tradewater's website at https://tradewater.us/.

Jessie Haas lives in an off-grid cabin in Westminster West, VT. She is the author of over forty books for children and adults.

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

Wright Construction

Cont'd from p.25

great thermal envelope. We do not do this as often as we would like." The structural materials, including the posts, beams, and pegs, came from local businesses, American Post and Beam in Claremont, NH. The SIPs were made by Foard, whose office is in West Chesterfield, NH.

The heating system in the house includes different technologies, but the main method of heat distribution is radiant heat in the floor. The system uses AdvanTech sub-flooring with Uponor Quick Track panels. This system was put to use in the addition, partly because it was oversized in the old structure, and partly because it fit well with the thermal gain from south-facing windows engineered into the addition. The finish flooring is made of engineered lumber, which was important for the radiant heat, and covered by a durable veneer layer.

The radiant floor system is enhanced by two Daikin air-source heat pumps that are highly efficient. They also provide cooling when that is needed. Both types of heat can be controlled remotely and intelligently. The house can be called by a cell phone and told when people will arrive and it needs to be warm. Because of the heat pumps, much of the time the house only needs a few hours warning that guests are about to arrive.

It is easy to see why this addition is award-winning. We congratulate Wright Construction Company on this award-winning project and their attention to efficiency they were able to incorporate.

Wright Construction Company is a company that has the expertise to build to the highest efficiency levels possible, which can cost the building owner much less to operate in the long haul. This is especially important because buildings can be major contributors to emission levels and our planetary climate crises. ♻

Factors That Determine Thermal Comfort *(Not Just the Thermostat!)*

Joanne Coons

When I was in elementary school, if my friend Wendy was cold in her house, her mother would have her run outside without a coat and come back in rather than turn up the thermostat. In late winter, if we have a 45-degree day and I need to slog back to the compost pile, I skip the coat, but if it was the same temperature in the middle of summer, I would throw on a sweat shirt. As I get older, I seem to be more sensitive to my thermal comfort and think about these scenarios. I was happy to attend and learn more about this topic at Efficiency Vermont's Better Buildings by Design in early February and registered for the session, "Lessons Learned, Thermal Comfort, The Next Energy Frontier" by Brian Just, Engineering Manager.

Statistically, one half of the people in the United States struggle to stay warm. There are six factors that influence thermal comfort. The first two are "personal factors," metabolic rate and clothing insulation. The last four are environmental factors, air temperature, radiant temperature, air speed and humidity. Building science can assign values for the metabolic rate such as sleeping (0.7) to walking at 2 miles per hour (2.0) to sitting (1.0), The clothing insulation is a compilation of all that you are wearing with assigned values from underwear to outerwear. Next, the environmental factors are considered. The first one, air temperature, is controlled by the thermostat or the "universal compensator." The second factor, the radiant temperature, is the "hot" and "cold" of surrounding surfaces that can make you feel uncomfortable. The radiant temperature factor is the one factor out of the six which is set at building construction time and is not variable. This is why it's possible to feel cold in a 72F room when seated near a cool window or wall and why insulated or radiant heated floors make you feel more comfortable. Simply put, heat travels from hot to cold. *[See More on Windows]*

The third factor, humidity, which is ideally controlled to a target of 35% to 55% (+/-5%) and keeps things like air quality, bacteria, fungus and viruses in check, provides respiratory eye and skin comfort and decreases condensation on windows and drywall. Lastly, air motion affects thermal comfort if the moving air is three degrees below the room temperature or is moving faster than thirty feet per minute. Thermal comfort is affected when the vertical temperature is greater than a five-degree difference from ankle to head. Scientific studies show that a comfortable floor temperature while wearing shoes is between 66.2 degrees to 84.2 degrees F. The goal here is to make 80% the people in the building happy.

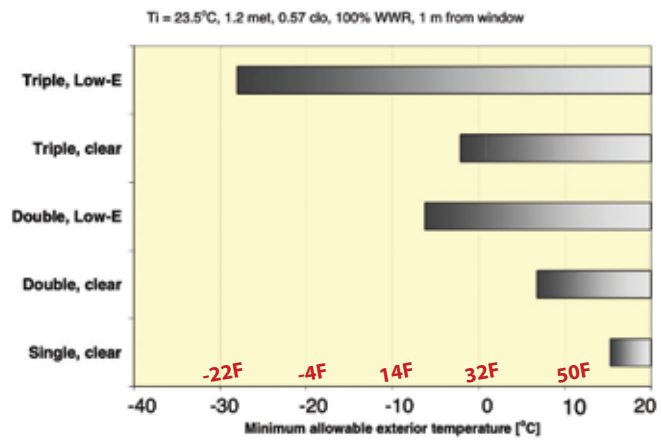
What does this all mean? Here is an example. When you are in a room set at 66 degrees and your goal is to make 80% of the occupants thermally comfortable, the thermal comfort factors that need to be changed if you want to achieve your goal are: put on two thick sweaters (clothing insulation), walk at a rate of two miles per hour (increase metabolic rate), or manipulate the environmental factors by increasing the floor temperature to 90 degrees F and the air temperature to 73º F. Measuring, monitoring and adjusting all these variables is a difficult task, and most people will just reach for the thermostat and crank it up. (Personally, I vacuum when I am cold.) None of this would be necessary if our buildings were built to a higher standard. A code level-built home scores a D or the worst that you can legally build to. Brian Just points out that buying a new code-level home "is like buying a new car, but the car was built in 1985." Sure, it is new, but none of the current technology or benefits of building science has been applied. Brian Just concluded his presentation with these recommendations: When designing a building, use at least two inches of continuous insulation which means no thermal bridging, triple pane windows, 1.0 air exchange per hour at 50 pascals pressure and a 24/7 high efficiency ventilation system with a Minimum Efficiency Reporting Values (MERV)13 filtration system. (Just stressed that if you don't purchase a high efficiency ventilation system, an aluminum core ventilation system will blow cold air on you.)

[See My Floor Feels Cold, top rt.]

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

More on Windows

These results indicate that even low-e, double-pane windows are only good to about 20F.



Winter window comfort rating – Minimum allowable exterior temperature.

Ref: Window Performance for Human Thermal Comfort: Final Report to the National Fenestration Rating Council, Center for the Built Environment & ARUP, Feb 2006 (http://bit.ly/Window-Thermal-Comfort).

Comparison of window performance at different temperatures from "Window Performance for Human Thermal Comfort," by Center for the Build Environment, Nov. 2005. (www.bit.ly/Window-Thermal-Comfort).

My Floor Feels Cold

Source: Brian Just

Contact coefficient (kCal/cm^{2}hr$^{0.5}$)

The higher the contact coefficient, the better the material is at drawing heat out of the feet.

- Concrete 25 • Linoleum 9
- Oak 7 • Pine 4 • Cork 2

Part 1: Integrating Social Equity into Green Building

James Wilson

Images from: onecommunityglobal.org

The causes of social inequity and injustice are deeply rooted within the systems that shape our society, including the built environment. The built environment represents the literal foundation of our society's presence in the world – from the smallest rural community to the largest city. The way in which buildings are designed, constructed, and maintained has a tremendous influence on the equity (or inequity), and the justice (or injustice), of our society. The way we build and the strategies we employ can either continue to worsen social issues or can lay the groundwork for significant progress to be made on these issues in places around the world.

The building industry continues to make progress on reducing negative environmental impacts of the built environment. In fact, we're increasingly seeing practices and strategies go beyond "sustainable" to "regenerative," with such goals as net-positive energy, water, and waste. Now, the industry is reckoning with the urgent need to integrate social equity into its definition of sustainability in order to also reduce negative social impacts of the built environment. We might accelerate the process by framing the goal as "net-positive equity."

Sustainability advocates in all sectors have come to recognize that an environmentally "sustainable" solution is not really sustainable if it is not equally accessible to all. Moreover, if health and economic benefits are unevenly distributed, the disparities in access and opportunity that form the basis of social injustices are reinforced. This recognition is driving efforts within the sustainable building community to develop an expanded definition of what constitutes a healthful, sustainable, and resilient built environment—a definition that fully accounts for the social component of the "triple bottom line" model of sustainability. (If You Are Serious About Sustainability, Social Equity Can't Be Just Another Add-On)

A useful way to frame this approach is through the concept of "just sustainabilities," which acknowledges that a pervasive "equity deficit" exists in most sustainability practices. The concept asserts that "a truly sustainable society is one where wider questions of social needs and welfare, and economic opportunity are integrally related to environmental limits imposed by supporting ecosystems"[1]. A just definition of sustainability would more accurately depict the ways in which the health and welfare of all people is inextricably intertwined with the health of the environment. Any effort that hopes to be effective at improving the quality of life for people, as with any effort to preserve or regenerate environmental quality, must be based in the understanding that social needs and environmental needs are interdependent. Studies have identified inequality as a primary cause of environmental degradation. Simultaneously, we know that the effects of environmental crises, such as climate change, by disproportionately burdening communities that were already disadvantaged, are greatly exacerbating social problems around the world.

The NAACP initiative Centering Equity in the Sustainable Building Sector (part of the organization's Environmental and Climate Justice Program), supports the idea that efforts to advance and secure social equity must begin by providing all people equitable access to a healthy, sustainable, and resilient built environment in which to live, learn, work, and play. Achieving this would have cascading positive effects throughout communities, helping to make them healthier, more resilient, and more just.

The NAACP's report "Getting Beyond Green: A Baseline of Equity Approaches in Sustainable Building Standards," emphasizes that the communities that are most negatively impacted by an "unhealthy, energy inefficient, and disaster-vulnerable" built environment are also "underrepresented in the design, construction, and occupancy of sustainable, regenerative, healthy buildings." The sustainable building sector has a lot of work to do to address this very complex and enduring issue, but fortunately several strategies have recently been developed and incorporated into green building programs. Programs including LEED©, the WELL Building Standard™, and the Living Building Challenge© can be used to integrate social equity goals into the design and development process of any project. Stay tuned for Part 2 of this blog in which we will demonstrate how these strategies can be integrated into planning, designing, constructing, and operating a sustainable building.

Part 2 of this blog, where we take a deeper dive into social equity and green building, will be shared in the next issue of *Green Energy Times.*

[1] *Julian Agyeman. Just Sustainabilities Development in an Unequal World. Edited by Julian Agyeman, Robert D. Bullard and Bob Evans, The MIT Press, 2003. p. 78*

Additional links available with the posting of this article on GET's website.

James Wilson is a Sustainability Consultant for Steven Winter Associates, Inc.

Reprinted with permission from Steven Winter Associates blog on September 20, 2020. ♻

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

A THERMAL IMAGE WALK-AROUND

Nate Gusakov

Recently we were called to perform an envelope assessment for a house under partial renovation in Starksboro, VT. After some interior demolition work, the builders had noticed squirrel damage to the insulation in the wall cavities they had exposed. They subsequently asked us to do a thermal imaging inspection of the house to make sure there wasn't further damage lurking unseen behind walls that weren't going to be renovated. It was a fairly simple process to walk around the house taking pictures with the thermal imaging camera. The amount of information gleaned from this simple walk-around is amazing. Here's just some of what we learned:

Images 1-A & B: Thermal and visual images of the west wall from the inside. Courtesy images.

Squirrels, you say? Squirrels, indeed. Take a look at image 1a. There is a painfully obvious thermal signature where the tree rats entered the top of the wall at the eave, tunneled their way back and forth down through the insulation between the studs, and fully excavated a cozy nest in the middle of the wall. Sigh! At least we know it's there, and now the builders can take care of it.

Now take a look at image 2, which shows the east side of the house from the exterior. Above the foundation in the thermal image, there is a relatively smooth color scheme across the exterior wall of the building. This indicates that the insulation is undisturbed here—there are gentle gradations of orange and yellow, but no distinctly contrasting colors.

Image 2 A & B: Thermal image of the east side of the building with a visual image inset.

Then, take a look at the foundation wall below the clapboards. To the human eye, it looks like one undisturbed stretch of grey concrete. To the thermal camera, however, another story is told in very clear terms!

The left side of the foundation wall is deep purple, showing that it is at least as cold as the snow. Halfway along the wall, the foundation suddenly changes to bright yellow and white, indicating a starkly different surface temperature, warmer even than the wall above it. What is happening here? In the south end of the basement (left side of the picture) the concrete walls are well-insulated on the interior, so heat from inside is kept inside. The north end of the basement is uninsulated bare concrete on the interior, so the wall there absorbs heat from the inside of the house, conducts it (very well, at that) across its mass, and radiates that heat to the outside, 24/7. To the thermal camera, it glows. To the homeowner, it costs money.

The thermal image walk-around is deceptively simple. It would take dozens of pages, however, to begin to fully unpack the amount of information that is gleaned about the building envelope. In this case, the value to the builders (and homeowners) is real and significant: Squirrel damage can be addressed on a case-by-case basis instead of tearing apart whole walls to investigate, and the rest of the renovation can proceed with confidence that a complete and functional thermal envelope will be the result.

Nate Gusakov is a building envelope consultant and AeroBarrier installer for Zone 6 Energy. ♻

Efficiency Vermont's EEN Contractor Spotlight:

Kramer Services of South Londonderry, Vermont

Interview with Stephen Kramer, Master Plumer and President

Green Energy Times staff

1. How did you get started in this industry and your company? What is your area of expertise?

I have been in business since 2004. We service and install equipment in VT from Manchester to Stratton, Mount Snow, and Ludlow. In 1987 when I was a kid, my mother and father built a house. I helped install a heating and central vacuum system. While I was installing the pipes and making the connections, it was then that I knew I wanted to be a plumber. I was intrigued with making the connections and figuring out the operation of the system. It was at that point that I knew I wanted to be in this business. In my junior year of high school, I went to a vocational school in the afternoons and was a master plumber by 1998 at 24 years old.

Kramer Service's area of expertise is home comfort. We specialize in geothermal heating and cooling, installation of energy saving products, high- efficient heating systems, radiant heat, and ultra-efficient cooling systems. We re-fit large commercial buildings in order to make them more efficient and save on their fuel costs. We [have] served over 1000 customers.

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

Water heaters and kitchen faucet replacements. It typically ends up with a phone call stating, "We have no water and there are guests arriving soon." If not done safely or properly, a water heater replacement could seriously hurt someone by being scalded, poisoned by carbon monoxide, or worse.

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

Air source heat pumps, either a mini-split or a water heater. Both are great ways to reduce the use of fossil fuels and lower one's carbon footprint. They offer a low price point for the homeowner, use latent energy from the mechanical room or the outside air, do not create a huge dent in your electric bill and will make you feel good about yourself, as you lowered your personal footprint.

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

We worked on a great project at Riley Rink at Hunter Park in Manchester Center, VT. The project reduce[d] the fuel consumption from 23,000 gallons of propane per year to 2500 gallons! The three- year project included a large solar array, multiple air-source heat pumps, air-source water heaters, and a mechanism called a "vortex." The vortex floods the ice sheet with cold water reducing the run time of the compressors and eliminating the need for another water heater, as hot water was used for every ice-make. This is a story I want every ice rink in America to hear! It is amazing, and we have the numbers to prove it

5. What is it in your field of specialty that is most valuable (re: to energy efficiency)?

Experience! We specialize in the best energy-efficient products on the market. When we arrive to a project, we look at the entire picture, from the thermal envelope, to the homeowner's lifestyle, even what their next 10–20-year plan is. From there we offer a design or piece of equipment that is right for that particular client. We are always training on the products we install, and we have the resources from the local supply house and the manufacturer to design a system that is right for the client.

6. Why should people use an EEN member over someone else?

With the support and training that Efficiency Vermont and the EEN network offer, there is no reason not to use the network. If I have a question or situation that needs another opinion, I can call fellow certified members. They can give a suggestion. Also, there are amazing rebates that you can only get if you use an EEN member. Material and products are not cheap. Using a resource like the EEN will help you save money, lower your carbon footprint, and have the proper equipment installed properly. This is a win-win situation for everyone.

7. What are ways to finance projects for residential or commercial projects?

Efficiency Vermont offers loans through VSECU. Your local bank can also help. Plus, Efficiency Vermont is always offering discounts with point of sale or mail-in rebates. These rebates are for many items such as thermostats, heating and cooling equipment, kitchen appliances, and windows. Your local utility company may also offer incentives.

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

My suggestion is to ask for referrals of previous projects, ask if the staff has proper training to install the equipment, and if they service the equipment they install. Ask, "Why did you choose this product or design?" You need to understand the logic and value of the products being installed, before you can make a clear decision of the investment you are planning to implement. Energy-saving upgrades can have high upfront costs, but the return on investment outweighs the overall installation cost. ♻

SOLAR POWERS PLYMOUTH STATE'S ENERGY EFFICIENCY

Peter Lee Miller

Plymouth State University's new rooftop solar array features nearly an acre of state-of-the-art solar panels. It is anticipated to offset more than 90% of the Physical Education Center's annual electricity consumption.

Plymouth State University's (PSU) venerable Physical Education (PE) Center has undergone an energy efficiency transformation. It joins the University's new climate studies major and "no charge" electric vehicle (EV) chargers as the latest evidence of the school's longstanding commitment to campus sustainability. Located in Plymouth, NH, amid the White Mountains and the Lakes Region, PSU is currently celebrating its 150th anniversary.

Nearly an acre's worth of state-of-the-art solar panels were installed in fall 2020. Covering all available roof space, the solar photovoltaic (PV) array offsets more than 90 percent of the center's annual electricity consumption.

The 518.4-kilowatt system consists of 1,296 panels rated at 400 watts each. "The array is expected to produce more than 606,000 kilowatt hours of electricity in its first year of operation," notes Physical Plant Project Director Walter Durack, who supervised construction.

This project was procured through a request for proposal (RFP) process and was awarded to KW Management of Nashua, NH, based on lowest price and KW Management's deep experience with similar rooftop solar projects across New England. KW Management was supported by Ted Vansant of New England Commercial Solar Services of Holderness, NH, throughout the project.

"Most of the electricity produced will be used by the PE Center," noted Vansant. "But on a sunny weekend day when there is lower energy use, the solar energy system will produce more energy than is being used, and the excess will be fed back into the New Hampshire Electric Co-op (NHEC) power lines. This will be measured by an electric meter so that NHEC, through a net-metering agreement, can credit the value to PSU, ultimately reducing PSU's electricity bill even further."

"This is an important step toward Plymouth State's goal of achieving carbon net neutrality for institutional electricity consumption by the year 2030," said Brian Eisenhauer, director of PSU's Office of Environmental Sustainability. "It's truly a win-win scenario that will save money while helping to meet our climate goals."

In 2009, the University became a charter signatory of the American College and University Presidents' Climate Commitment. As part of that commitment, the University developed a Climate Action Plan in 2010 and pledged to reduce campus greenhouse gas (GHG) emissions by 50% percent by 2025 and to make its operations GHG-neutral by 2050.

In 2013, PSU worked with Greener U to develop a Climate Action Implementation Plan. The PE Center Solar Array Project is in accordance with that plan, which provides tangible steps and timelines for achieving sustainability goals.

Construction of the $822,000 system is expected to save the University $100,500 in electric utility charges in its first year of operation. Transitioning the electric supply for the PE Center from the regional electricity distribution grid will reduce the University's annual carbon emissions by 473 tons, according to the EPA's Greenhouse Gas Equivalency Calculator. This is the equivalent of taking 93 passenger vehicles off the road for one year.

Cont'd on p.33

Phillips Exeter's Green Academy Awarded Sixth LEED Certification

George Harvey

Phillips Exeter Academy has nearly 1,000 students in grades nine through 12, and it has an outstanding reputation. Describing itself, it says, "The Academy is committed to creating a culture of diversity, equity and inclusion and being an anti-racist community. Environmental and fiscal stewardship are also strong values that we teach and live by. Our built environment should support our mission, values and programs."

Above: The Thompson Field House at Phillips Exeter's Academy. Right: the solar array on the roof of the Thompson Field House. All photos courtesy of Architectural Resources Cambridge

For athletics, the academy has 22 different sports with 62 interscholastic teams. Some attention has to be put into both the buildings used for sports and the efficiency of those buildings. One of these is of particular interest.

In early 2018, the academy opened its new William Boyce Thompson Field House. In its 85,000 square foot area, it has a 200-meter, six-lane indoor track, within which are four tennis courts. It has separate dedicated areas for shot put, high jump, long jump, triple jump, and pole vault. The mezzanine has an 8,000 square-foot area for wrestling along with 4,000 square feet for other purposes. There are bleachers for 500 spectators. Beneath the building is a parking area for 169 cars.

The environmental approach of Phillips Exeter Academy is impressive. On a campus of this size, there will always be projects in development. For several years, the school has undertaken to see that the environment is a central issue for each. It is an issue that has also become part of the curriculum and the way of life at the school. Anyone interested in this might enjoy reading an article that appeared in the spring 2020 issue of The Exeter Bulletin, "How green is Exeter?" This can be seen online at www.bit.ly/Exeter-green.

Among the things we learn from that article is that the school has a number of LEED-certified buildings. The Thompson Field House follows other buildings that have been awarded LEED certification; there are now six all told.

The new field house was designed by Architectural Resources Cambridge (ARC), which was given instructions to be "flexible and creative to develop beautiful and functional and regenerative landscapes surrounding the project." It was also designed to meet the LEED standard for gold certification. This is not a trivial process, and the project under design was very large, so ARC also used the services of Steven Winter Associates, Inc. as a sustainability and energy consultant.

The design of the Thompson Field House had included good insulation, efficient heat, and carefully engineered lighting. But it had to go further in ways that many people do not think about much. For example, there were materials reserved for reuse from the deconstruction of the previous building at the site. One case is wood flooring used for the older building's wooden track, which ended up being given a new life in the new facility's multi-purpose room.

As we might imagine, water use was an issue that needed to be addressed, but in this case, there were special considerations. Because of the proximity of two rivers, pervious pavement was used and areas devoted to cars were reduced to allow for a more natural landscape. This was a reason why an area for cars was included in the basement. Also, buffer areas are maintained on the bank of the nearby Little River. Part of the effort is a 10,600 cubic foot bio-retention facility to handle stormwater runoff.

The new building is designed to fit in visually with other nearby structures, in a way that is similar to the building it replaced. This could have been done by using limestone, as older buildings did. The aesthetic could be achieved at a much lower cost by using glass-fiber reinforced concrete, which can be made to look quite similar.

Crowning the design of the Thompson Field House is a solar array on the roof. The array has 1,552 panels giving it a capacity of 535 kilowatts, and it can provide 75% of the building's electricity needs. It was installed by ReVision Energy, a company well known to the readers of *Green Energy Times*. In the article mentioned above, we learn the rather interesting fact that over its lifetime, this array will generate enough electricity to provide for a day's use by New York City. A more conventional statement is that each year it will offset the equivalent of driving cars about a million miles. This array produced 608,000 kilowatt-hours in 2020, and is expected to save the school about $2 million over its lifetime.

Because of the Covid-19 pandemic, the Thompson Field House has not had a formal post-occupancy evaluation. Nevertheless, it is clear that both Phillips Exeter Academy and Architectural Resources Cambridge intend to use the field house as a model for later design projects, both on this campus and at other schools. ♻

The pole vault area in the Thompson Field House at the academy.

PLYMOUTH STATE'S SOLAR – *Cont'd from p. 32*

Plymouth State University recently launched a new bachelor's program in climate studies , becoming the first institution in NH, and one of very few in the country, to offer it as an undergraduate degree.

The project provides students with a first-hand view of renewable energy and furthers their understanding of the technology behind it. "During my undergraduate career, I served as president of Common Ground, the student environmental and social justice organization, and I received a minor in sustainability," said PSU graduate student Briana Stewart. "These experiences helped me evolve into a more environmentally-conscious person in my everyday life and local community, and the new PV array is just another great example of sustainability here on campus."

"I hear a lot of institutions committing to be carbon-neutral in X number of years, but PSU is demonstrating through this solar array project that it is serious about making carbon net neutrality happen," added Alyssa Griffin, a meteorology undergraduate student.

Climate change causes, effects, mitigation, adaptation, policy, communication, and education are some of the most important issues of our time, and PSU is addressing the need for trained professionals for private industry and government jobs working in the various aspects of the climate crisis. Plymouth State's new bachelor's in climate studies program is the first of its kind in New Hampshire and one of very few in the country.

The program will prepare students for private and public sector careers in fields such as emergency management, conservation, public policy, tourism, science journalism, planning, and a variety of other fields in which climate concerns play a role.

"Climate study is a rapidly-evolving and expanding field, and our program will give students a strong foundation of knowledge and skills," said Professor of Meteorology and Climate Studies Program Coordinator Lourdes Avilés. "The University's Integrated Clusters interdisciplinary approach will help students learn to think critically, adapt, and work collaboratively—all essential attributes for our fast-changing world."

Those wishing to check out Plymouth State's green initiatives (or just traveling up I-93 through central New Hampshire) are invited to bring their electric vehicles and charge up for free! Two EV chargers are now available on campus. Thanks to NHEC, the installation came at no cost, and, thanks to PSU, the charging is free as well.

To learn more about Plymouth State University online, visit www.plymouth.edu.

Peter Lee Miller is Plymouth State University's associate director for communications and marketing. His background includes freelance writing for the American Wind Energy Association (AWEA), advising the Lake Sunapee Protective Association and other organizations, and co-hosting the Society of Environmental Journalists national conference. He teaches a PSU journalism course and hopes to offer Environmental Journalism next spring. ♻

Elmore Roots' Permaculture Know-How

The Rain in Spain Falls Mainly on The Plain

David Fried

I hear the ice dripping as it is finally above freezing after a long winter.

The hail bouncing off my coat on my morning walk has turned to rain.

On the first warm day each rain drop leaves an animal at the spot where the raindrop touches the earth.

Drip, drip, there are two otters.

Plunk, plunk, there are two beavers.

Splash there is a porcupine.

As soon as they touch ground, they start walking.

Didn't you always wonder where they came from?

Thunk, there is a fisher cat, all you others better watch out!

The animals find somewhere to go in the rain.They are already wearing their coats that shed water (while we have to get ours from the store or our brother who outgrew his).

The plants do not have a choice. They are here for the long haul, like rocks and postal service people. They are outdoors in sun, rain, sleet or snow. "Makes us tougher for it," they say.

Some refer to snow as "poor man's fertilizer." So, what is rain, a poor man's spa?

A beaver scampering through the rain drops. Painting by Vermont artist Gabriel Tempesta

In my early days in Vermont in the late 70s, I lived behind my friend's house in a tent on the Missisquoi river up north in Westfield. The river waswhere I dunked into to get clean.

When it rained and I was in the water, I did not get wet or mind it, as there was no separation between me and the water. This is probably how plants feel all the time. As a grower of plants, I notice the delicate balance for a tree or smaller plant. If they are too hot and dry, they let us know by wilting that they need water badly.

Tomato plants can perk up from nearly being dried into dried herbs by letting their roots sit in water for an hour. Most trees will also come back from a drought after leaving a slow dripping hose next to them or giving them one or two five-gallon buckets of water.

But plants in the Ericaceae family cannot come back from being dried out. This is probably due to them not having root hairs that absorb water. Plants in this family include lowbush cranberries, lingonberries, azaleas, rhododendrons and blueberry bushes. They must be used to growing where the conditions are favorable for a plant like them. Mossy, spongy, acid soil, well drained but moist most of the time, seems to be what they like. It is very important when growing these plants to not let them dry out when they are first transplanted or during serious dry spells. Mulching with tree bark or compost or leaves is a good way to help maintain moisture around the roots of these plants.

As a boy, I remember getting stuck outside in my neighborhood on a warm

summer's day during a downpour. At first, I resisted the rain, as I had learned as a kid that you are not supposed to get wet unless you are taking a bath. Not having a choice, I got soaked really quickly and remember lying down on the warm sidewalk in a puddle, stretching out my arms and legs in the pouring rain to just feel that awesome rain all over me. I was one with the rain and I was very, very happy.

This is how plants probably feel all the time. They are just waiting for the next rain. All us two- legged ones go inside somewhere, and they get to be out there in all the majesty. Dripping wet and stretching their roots deeper into the earth than last time it rained. They keep growing from their experiences. They keep hoping we two-legged ones will also grow from ours.

David Fried is a writer and grower of fruit and nut trees and berry plants at Elmore Roots. ♻

An E-mower User Experience

Larry Plesent

I don't know about you, but mowing lawns is my least favorite chore. I save up projects to do on my weekends and truly resent the time involved in maintaining the lawns at our two business locations in Rochester, VT while keeping another two acres of grass and fields in check on our rural homestead. I will build decks, gardens, patios, ponds and expand the parking area; anything to lessen the mowing chores. Goats or pigs are probably in our future somewhere.

Despite my best efforts last year, I paid $1500 in mowing services. This did not make me particularly happy either!

After researching options online, here are my conclusions.

First, for us a standard push or self-propelled mower is out. Too much real estate to cover and though I often act like one, I am not a kid with boundless energy anymore. Looking at the ride-on mowers made me somewhat depressed. Was I turning into yet another silver-haired guy endlessly riding around on his mower waiting for his next medical emergency?

I came dangerously close to buying a well- rated and reliable $2,000 ride-on with a 52" deck before finally coming to my senses. What I needed was a small zero-point turn mower. These are those often-giant mowers that the professionals ride or stand on that zip around the yard in about one-third the time of conventional ride on mowers. A smaller nonprofessional gasoline zero-point mower starts at about $3000.

Now for the hard part.

I made a personal commitment this New Year's to systematically phase out internal combustion engines in my world. Whenever I buy a new motorized device, I pledged to go electric with my purchase. Starting with the biggest purchase, a leased 2020 Chevy BOLT (which I genuinely enjoy driving), it became clear that the next step in the chain had to be electric mowing. And so, I switched gears and decided to go electric.

Electric lawn care has taken a huge technological step forward this year. Most major brands have at least a couple of electric offerings in their mix. Maybe you enjoy fussing with finicky small engines that sit in a cold garage eight months out of the year, but for most of us; probably not our favorite hobby. What if there was no gasoline to mess around with and to inhale, no oil to change, no spark plugs to check, clean and replace, no starter fluids and no replacement starter ropes or dirty carburetors? And especially, what if we eliminated the unfiltered emissions that we exhaust into the same atmosphere that all of us depend on to stay alive?

Spring is here and Larry Plesent is ready to use his e-mower again. Courtesy photo.

Fortunately, one company has risen to the challenge. RYOBI makes a simply awesome lower cost rechargeable zero-point turn mower. It is carried by Home Depot. I bought mine at pre-season sale prices and paid $3150. The sales tax was mostly covered by the additional 5% discount received by putting it all on a new Home Depot credit card.

How good is it? Well, a zero-point mower is very fast, a kind of souped-up electric go cart with two grass cutting fans underneath. It is steered by using two levers rather than a wheel, which takes a couple of hours of practice to master. The RYOBI mower has a low-speed button which is terrific for newbies like me still developing his chops. Despite my best efforts, I quickly drove the new mower into the ditch alongside our winding rural driveway. It turned out that the machine was light enough to muscle out without a tow. Test #1: Passed the drive-into-the-ditch test.

Test #2 came when I plugged it in to charge overnight. I had not yet cleaned out the barn to make room for the new machine, so I kept it outside its first night on campus. And of course, it rained. A hard and steady rain at that. Cautiously I wiped down the seat and body with a towel. It started immediately and without complaint. Test #2: Passed the left-out-in-the-rain test.

The third test was a big one. Like many zero-point newbies, I soon drove it into the pond. Well more like I got too close and it slipped into the pond but let us not make excuses. "Learning curves" can be brutal. Running for the tractor, I pretty much convinced myself that I had just destroyed my new toy. I quickly returned to find the mower bobbing in the water pretty much where I left it. The thing actually floats! Winching it out, I dragged the thing up towards the house and toweled it down. Cautiously I turned the key, and it started immediately! Test# 3: Passed the drive-into-the-pond test with flying colors. Amazing.

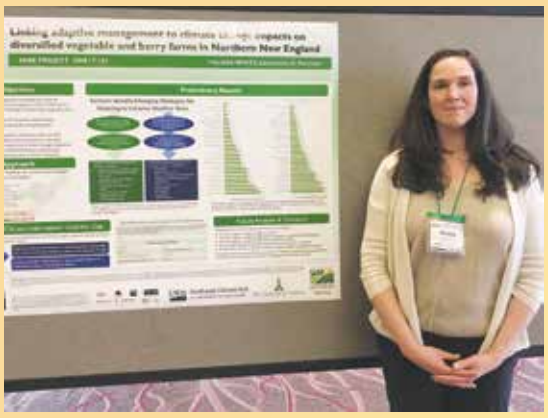
Now I look forward to riding my electric go-cart speed mower. It is fun and does a great job at anything short of a brush hog's work. It took out young canes just fine but shut down the blades when they came in contact with small saplings. Smart machine! Apparently smarter than the owner operating it. The RYOBI charges quickly at twelve volts (compared to the car) and runs for 2-1/2 hours or more on a single charge. That's over two acres of mowing.

If you want to reclaim YOUR weekends while having fun and reduce not only your carbon output but your cancer and asthma loads through zero emissions, I highly recommend the RYOBI zero-point mower as an affordable residential and small-business-property option. The RYOBI is reliable enough for professional use in high density residential areas where noise can be an issue and a smaller mower is called for. You know, considering how much I enjoy the mower, maybe I won't expand the deck this year after all.

Larry Plesent is a writer, philosopher and natural products formulator living and working in the Green Mountains of central Vermont. Read more at www.vermontsoap.com/category/blog/. ♻

Successful Farming Practices in the Face of Climate Change

Debra Heleba



Alissa White shared results of her Northeast SARE-funded research project looking at climate change impacts on vegetable and berry farms at a national conference.

When farmers and growers throughout the Northeast go to work, they know they will face unpredictable weather. After all, Mark Twain's adage, "If you don't like the weather in New England, just wait a few minutes," referred to New England's erratic weather conditions. However, experts predict that global climate change means that the Northeast will see even more volatility in both the intensity and frequency of weather extremes over the coming decades.

Since excessive wet and dry conditions can lead to crop losses, it is important to understand the strategies farmers can use in the face of climate change. The University of Vermont's Alissa White sought to do just that. She secured a grant from the Northeast Sustainable Agriculture Research and Education program (SARE) to uncover practical strategies farmers may use to proactively address climate change-related risks on their farms.

White reached out to more than 350 vegetable farmers and fruit growers through surveys and focus groups to learn what farmers were currently doing and how they were planning to manage weather-related risks. She said, "The project started from a place of recognizing that farmers were already adapting and innovating in the face of the extreme weather impacts of climate change. I think they really appreciated being recognized as experts in what they do and being acknowledged for being on the front lines of climate change. Farmers are adapting to climate change in many different ways, and there are a lot of successful strategies being used within the farming community that we can learn from."

Her research revealed that the majority of farmers she reached were already using strategies to manage their farms to adapt to extreme weather conditions. More than 60% said they used cover crops and soil health improvements to mitigate risks associated with both heavy precipitation and drought. In particular, cover cropping—used by 88% of farmers in the study—was named as an effective strategy to safeguard vegetable and fruit crops from erratic weather events.

White's research results have important environmental and social implications. The practices farmers are using protect soil and water quality and provide additional environmental benefits. White also recognized that farmers appreciated discussions with other farmers about climate change. She said, "…farmers thanked us for bringing up climate-impacts because no one else was talking about it." White found that farmers rely on farmer-to-farmer knowledge exchanges as the primary ways they learn about these practices and noted that farmer networks are critical for continued learning and peer support. Results of White's project are available at https://projects.sare.org/sare_project/gne17-163/.

Based on what she learned, White advises farmers and gardeners to plan for both wet and dry conditions. She said, "These weather extremes are happening more frequently and that's not going to change anytime soon. Invest in soil health—it will support your capacity to deal with both extremes. Keep the ground covered, with roots or mulch or cover crops, to limit erosion during heavy rain events and reduce evaporation during drought. If you can plan it into your landscape, [try to] slow and catch water from heavy rain events—this will limit the damage it does and maybe you'll be able to store it for when you need it during times of drought."

SARE has published several books and bulletins on successful farming strategies that may be used in the face of climate change, including the bulletins, "Cultivating Climate Resilience on Farms and Ranches" and "Smart Water Use on Your Farm or Ranch." Both highlight SARE-funded research on practices like conservation tillage, cover crops, composting and crop rotations. SARE's popular books, "Building Soils for Better Crops 3rd Edition" and "Managing Cover Crops Profitably," provide practical information on ecological soil management and commonly used cover crops. They can be found at www.sare.org/resources.

Cover crops in a melon field. Cover crops can increase water infiltration and water-holding capacity making them an effective strategy for mitigating risks related to climate change. Photos: Candice Huber, Northeast SARE.

In addition, a new interactive online cover crop selection tool is now available to support decision-making around cover crops; find it at http://covercrop.tools.

Debra Heleba is the regional communications specialist at Northeast SARE. Funded by the USDA, Northeast SARE offers competitive grants and sustainable agriculture education to address key issues affecting the sustainability of agriculture throughout our region. More information: www.northeastsare.org. ♻

RESOURCES

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

To join this group go to: **http://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**

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

NEW 'MOW ELECTRIC!' CAMPAIGN

The Mow Electric! campaign is a grass-roots, community-powered initiative promoting the transition to battery-electric lawn care equipment uses for both residential and commercial applications. This campaign is based on the understanding that human-caused climate change poses an existential threat, and that the US lawn care industry's annual consumption of billions of gallons of fossil fuels is no longer acceptable now that practical and cost-effective electric alternatives are widely available. This transition to electric lawn care equipment will reduce the vast sums of money leaving the region to pay for imported fossil fuel and will also improve the quality of life in our communities by reducing noise and air pollution.

The Mow Electric! campaign is focused on raising the awareness among Vermonters regarding the significant ecological and economic benefits of electric lawn equipment, with the goal of rapidly and dramatically increasing the use of e-lawn care equipment by homeowners and renters, businesses, multi-family property owners, institutions, local and state government, and lawn care contractors. The campaign also hopes to influence policy efforts and legislation that would expand the use of electric lawn equipment, as well as other emission-reducing technologies within the public and private sectors.

Here are some ways you can get involved in the Mow Electric! campaign:

- Provide a **product review** if you use battery-electric lawn care equipment.
- Provide an e-lawn care **testimonial** if you use battery-electric lawn care equipment or hire an e-lawn care contractor and inspire other Vermonters to make the switch.
- Become a local **Mow Electric! ambassador** to answer questions and demonstrate equipment to residents in your town who are considering making the switch.
- **Encourage lawn care contractors** to start using battery-electric equipment.
- **Become a Mow Electric! champion.**

The Mow Electric! campaign offers a variety of tools and resources to individuals who want to help advance the goals of the Mow Electric! campaign in their local communities. These include: an interactive spreadsheet comparing the operating costs and environmental impacts of battery-electric versus gas-powered lawn care equipment, sample newspaper articles or letters to the editor, and contact information for the national e-mowing advocacy organizations Quiet Communities and the American Green Zone Alliance (AGZA).

Visit the Mow Electric! website to learn more: www.mowelectric.org. ♻

GUIDE TO ADVERTISERS

Green, Clean Paint

Jessie Haas


Flickr/United Soybean Board

Spring light always seems to reveal mess and dinginess that has accumulated over the winter and, for centuries, has kicked off the ritual known as 'spring cleaning.' Painting has long been a part of spring cleaning. In the old days it was most often whitewashing, which used a solution of water and slaked lime or calcium carbonate. In older houses you may still see traces of this white paint in dirt cellars or old dairy barns, but it was used as exterior paint too. Whitewash is mildly antibacterial, and when applied repeatedly on rough surfaces, such as barn interiors, removes debris as it flakes and drops to the floor. Whitewashing was also nontoxic.

Today our impulse to whiten and brighten our homes is a lot more problematic. Paint manufacturing is a significant source of pollution, and paints and stains can contribute to unhealthful indoor air. The worst of the worst, ironically, is the color we associate with cleanness. White paint is most often pigmented with titanium dioxide (TiO_2). This has high embodied energy. Emissions during manufacturing include CO_2, N_2O, SO_2, NOX, CH_4, and volatile organic compounds (VOCs). The waste stream includes spent acid and metal sulfates. Raw materials are derived from scarce resources. TiO_2 is also implicated in the high rate of cancer among professional painters. (Colored pigmets can have impacts, but generally are not as intense.) When buying a white or light-colored paint, look for one that is water-based paint (the vast majority of paints available to the consumer), with low TiO_2 content, low quantities of binder, and low levels of organic solvents.

VOCs are the element of paint hazard that most people have heard of. These come from solvents added to help paint dry, to facilitate mixing, or to provide better coverage. After application, they can continue to emit for up to a year. VOCs react with oxygen to form an ozone layer in the presence of sunlight, contributing to smog and to global warming as part of the greenhouse effect.

But it's their contribution to poor indoor air quality that has given VOCs their bad name, and they have other common sources which accumulate in the home. Paints, strippers, solvents, wood preservatives, aerosol sprays, cleaners and disinfectants, moth repellents and air fresheners, stored fuels and automotive products, hobby supplies, dry-cleaned clothing, pesticides, building materials and furnishings, office equipment chemicals, graphic and craft materials including glues, markers, and photographic solutions, are all sources of VOCs. They cause eye, nose, and throat irritation, headaches, loss of coordination, nausea, damage to liver, kidney, central nervous system damage, and cancer.

Luckily there are many ways to avoid VOCs and other harmful aspects of paint. The simplest may be to hire an eco-friendly painting service and leave it all to them. If you want or need to be more minutely involved, check out The Good Trade, which lists eight enviromentally friendly paint lines on its werbsite. Some are from nationally known companies like Sherwin Williams. Others are more obscure. Cleaner, safer paints tend to be more expensive, but Behr puts out a zero VOC line of paint that is more affordable. Green paints are especially important in well-insulated houses with a tight thermal envelope, so if you've done your work in that regard, you owe it to yourself to choose paint wisely. Look out for biocides/fungicides, toxic pigments, and VOCs. EPA requirements allow no more than 250 grams per liter (g/l) of VOCs in latex paint labeled low VOC, no more than 250 g/l in oil-based low VOC paint. Some makers including Behr and Sherwin Williams have lower options between 50 and 150 g/l, and some have zero. Low VOC interior latex paints come in matte, eggshell, and semi-gloss finishes. For exterior use, Behr has an acrylic, low VOC paint that resists mildew, fading, and staining.

Other options include milk paint, which is made of milk protein, limestone, clay, chalk, natural pigments. Milk paint is biodegradable with no VOCs. Powder is mixed with water to a thin creamy consistency and is used for wood furniture or lime plastered walls. Chalk paint gives furniture a distressed matte finish, with no prep needed other than cleaning; it offers low VOCs and can be used indoor and out. Ceramic paint is antimicrobial and low VOC. It is durable, repels smoke, dirt, and bacteria, and eliminates growth of mold and mildew. Linseed oil paint is solvent-free, made of flax oil and natural pigments, and it can be used on wood, masonry, metal and plastic indoors and out.

People living a vegan lifestyle may want to bear in mind that some paint ingredients have animal origins, such as casein, a milk protein, and shellac, a resin exuded by the female lac beetle.

For an eco-friendly ethical design contractor look for National Association of the Remodeling Industry (NARI) certification, or Leadership in Energy and Environmental Design (LEED) certifications and experience.

Source links available on our website.

Jessie Haas lives in an off-grid cabin in Westminster West, VT.. She is the author of over 40 books for children and adults. ♻

1.56 Billion Face Masks are Just the Beginning

Dr. Teale Phelps Bondaroff

As a result of the COVID-19 pandemic, the production and use of personal protective equipment (PPE), such as masks and gloves, has skyrocketed. While PPE offers important protection from the virus, its improper disposal has led to a surge in plastic pollution.

In late February 2020, about six weeks after Covid-19 had reached Hong Kong, OceansAsia team members visited a remote beach on the Soko Islands, south of Lantau. Along 100 meters of beach they found 70 single-use plastic face masks. On every subsequent visit to a beach, our teams have found dozens of masks.

Gary Stokes, Director of Operations for OceansAsia, holds up dozens of face masks collected on the Soko Islands, Hong Kong (Image: Naomi Brannan/OceansAsia.org)

After breaking this story, we set about to determine how many face masks were likely entering our oceans. From a global production projection of 52 billion masks for 2020, and assuming a conservative 3% loss rate, we estimate that at least 1.56 billion masks entered our oceans in 2020. This amounted to between 4,680 and 6,240 metric tonnes of plastic pollution.

Unfortunately, face masks are just a small part of marine plastic pollution, and they constitute a fraction of the more than 8 million metric tons of plastic that enters our oceans each year. This plastic does not go away, but rather accumulates, breaking up into smaller and smaller pieces. The typical surgical mask, for example, is made from melt blown polypropylene and could take as long as 450 years to break up in the marine environment, all the while serving as a source of micro plastic and having a negative impact on marine wildlife and ecosystems.

Plastic pollution has impacts on wildlife and ecosystems in a number of ways. Larger pieces of plastic can entangle wildlife, leading to limb amputation, suffocation, and death, as well as scour and destroy corals. Smaller pieces of plastic are easily ingested, and can bioaccumulate in animals and bio magnify in predators. Plastic adsorbs toxins, so that when ingested it can poison animals, sometimes killing them outright, and in other instances weakening them so that they are more susceptible to disease and predation. It is estimated that annually marine plastic pollution kills 100,000 marine mammals and turtles, over a million seabirds, and even greater numbers of fish, invertebrates and other marine life. Plastic pollution also has profound impacts on coastal communities, fisheries, and economies.

Unfortunately, not only has the consumption of single-use plastic PPE increased dramatically during the pandemic, but so too has the consumption of plastic in general. Concerns about hygiene and a greater reliance on take-away and home-delivered food have led to increased plastic waste production. At the same time, a number of measures designed to reduce plastic consumption, such as single-use plastic bag bans, have been delayed, paused, or rolled back. Increased waste production has overwhelmed many waste management systems, leading to the loss of more plastic into the environment. PPE also presents challenges to waste management systems as it is very difficult to recycle, particularly because it is often made from multiple materials, and due to safety concerns.

Our oceans are filling with plastic and we must act now. Action is needed at every possibly level to address the serious threat posed by marine plastic pollution.

When possible, individuals should choose to wear reusable masks and masks made from sustainable materials. Masks should always be disposed of responsibly. In general, we should all strive to reduce our consumption of unnecessary single-use plastic, purchase from companies that offer these alternatives, and encourage other companies to reduce their use of plastic.

Governments have a central role to play in efforts to reduce single-use plastic. There are a wide range of policy instruments that can be implemented, which include measures designed to change consumer behaviour, bans on unnecessary products, market-based instruments, legislation designed to hold producers accountable, and incentive and support programs. With respect to masks, governments should implement policies designed to encourage the use of reusable masks. The release of guidelines regarding the proper manufacture and use of cloth masks is a good starting point. Other policies should include such measures as educating the public about, and removing barriers to, safe mask disposal, coupled with effective fines for littering. Governments should also support innovation and the development of reusable and sustainable alternatives to single-use plastics and accelerating efforts to reduce their use.

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The Environmental Impact of Our Choices

Marc Morgan

We are all familiar with the 3R's: Reduce, Reuse, Recycle. This concept of managing our waste is now taught to our children as soon as they get into school. Many youngsters are learning it at home, before they get to school.

The 3R's are the preamble to what is commonly referred to as the solid waste management hierarchy. The hierarchy presents management options in order of preference. Reducing waste is the option given highest preference and disposal is obviously the least preferred option for waste. Unfortunately, these options are not always easy to implement. Recycling provides a great compromise.

It is clear why reducing waste is more preferred than disposal, but why would reuse be better than recycling? Both options reduce the amount of waste making its way to a landfill. Right?

To illustrate the environmental impacts from reuse vs recycling; I will use single-use bottled water as an example. We are all familiar with these small plastic bottles. They can be found at conferences, gas stations, vending machines and in our home refrigerators. The Beverage Marketing Corporation stated in a recent report that in 2019 the average American consumed 43.7 gallons of bottled water; up nearly 4% from 2018. That amounts to more than 40 billion bottles annually. The production of plastic bottles alone accounts for the equivalent greenhouse gas emissions of 800,000 cars on the road annually.

There is no doubt that drinking water is a healthy choice, but what is the impact of all those bottles and is there a better option?

Single use plastic bottles are recyclable. According to the National Association for PET Container Resources (NAPCOR), the recycling rate for PET containers (plastic beverage bottles) is less than 30%. Most single-use bottles are making their way into landfills and incinerators. Very often single-use water bottles are consumed away from home where recycling options may be limited. More than 45 million barrels of oil are required annually to produce our bottled water packaging.

Disposal is not the only issue with single use water bottles. According to a 2017 report by Food & Water Watch, nearly 64% of bottle water comes from a municipal water source. That means that consumers in the Upper Valley are spending more than 700 times the price of tap water because it comes in a bottle. This water is also traveling long distances. In some cases, bottled water is coming from the other side of the country; Nestle water has bottling plants in California. The environmental impact of transporting water thousands of miles cannot be ignored.

So, what is the alternative? Simple. Use a reusable water bottle. In one year, using a reusable water bottle prevents the creation of nearly 1,500 plastic bottles. That is a whole lot of plastic. Avoiding the creation of the bottle reduces the amount of waste making its way into a landfill.

Refilling at the tap also reduces your transportation footprint. Since many brands of bottled water are produced far from consumers, using local municipal water resources is not only good for the environment but will save you money.

The City of Lebanon's Solid Waste Division sets the month of April aside as "Refill NOT Landfill" month. During this campaign, Lebanon partners with the Coop Food Stores by asking upper valley residents to think about their waste practices and to choose to reuse for the entire month. For the 2021 Refill NOT Landfill campaign, we are focusing on reducing the consumption of bottled water and asking folks to drink local… at the tap.

This month, do your part to reduce single-use bottled water by: buying in bulk; if you need to, carry a water bottle, and if you are eating out, ask for tap water.

For more information about participating in this year's campaign, check out www.lebanonnh.gov/1290/refill-not-landfill.

Marc Morgan is the Lebanon, NH Solid Waste Manager for the Department of Public Works. To learn more, check their website at https://lebanonnh.gov/Waste-Recycling or call 603-298-6486. ♻

Green-minded grocery shoppers spend more time in the bulk-products aisle than your average consumer, given their preference for avoiding disposable single-use packaging on products. Image: leyla.a, FlickrCC.