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Climate Change Is Pushing Record-Setting Disasters

George Harvey

It is amazing what an increase of 1°C (1.8°F) can do. As the world has warmed by just that amount, disasters have grown fast. And the disasters are clearly more numerous and worse because of a little bit more heat. According to the UN Office for Disaster Risk Reduction, the costs of disasters in the period of 2000-2019 were 182% of what they had been for 1990-1999, adjusted for inflation (<http://bit.ly/UNDRR-report-2020>).

A large part of the problem has to do with the fact that over 90% of the additional heat that hits the Earth is trapped in the ocean. In some places, the water is much warmer because of this. Parts of the Gulf of Mexico have been hovering at 6°F to 8°F higher than normal during the summer.

That heat makes water evaporate faster, and because the air is warmer than usual, it can hold more moisture. The hot water also heats the air above



Hurricane Delta. NASA image.

it, making it rise faster, and the up-drafts fuel hurricanes. The combination makes what might have been a much less powerful storm in years gone by grow instead into a major hurricane. And that is what we have been seeing.

When the weather people who name storms run through the alphabet's names, they continue with Greek letters for names, starting with Alpha. This year is the second time that has happened, and the first time a storm named for a Greek letter has hit the U.S. That was Hurricane Delta, which made landfall in a part of Louisiana called Cameron Parish. (In Louisiana, counties are called parishes.)

Cameron Parish is particularly interesting because it was the place Hurricane Laura made landfall on August 27, 2020, only 25 miles west of where Delta did. The first of these storms tore the area apart, covering the land with debris, and the second turned the debris into projectiles to slam those buildings that had survived.

Cameron Parish is also interesting because of two other things. One is that a couple of years

Cont'd on p.3

NEW ENGLAND IS ALSO ON FIRE

What a record fire season signals about the future of a wet state.

Philip Kiefer

In mid-May, Chris Easton, an assistant fire chief in the town of Dixmont, Maine, was standing in his yard when he noticed a huge column of smoke on the other side of town. Figuring that he'd go make sure a neighbor wasn't burning a brush pile before alerting the department, he headed over to scope out the fire.

Then, his pager began going off, and it was clear that the fire was not under control. A neighbor with an ATV gave him a lift to the source of the smoke, near an open patch of power lines. "As I got there," said Easton, "this column of black smoke exploded into flame." By the time backup arrived, 15 minutes later, the fire had spread to four acres. The torched trees were unlike any fire Easton had seen in Maine. "Generally, the trees aren't that dry," he said. "But this was kind of the perfect spot for it to happen. It was low-growth fir and spruce, with taller trees above, and the fire just laddered. The only time I'd seen that was out West."



Looking down into a forest fire. Image: Wikipedia Commons/defenseimagery.mil

This year, tales of massive wildfires in the western United States have dominated the news. But Maine has also had a record-breaking fire season. Over 900 fires have burned across the state. An average year sees more like 600. Like the fires out West, there are many factors behind Maine's re-

cent increase, and climate scientists say that it's unclear what role climate might play in the region's fire seasons. But the firefighters responsible for Maine's wildlands wonder if this year is a preview of those to come.

Unusual weather, uncertain causes

The underlying cause of Maine's fires is a prolonged drought, in place *Cont'd on p.33*

Is This the End of the World as We Know It?

Or is it something else altogether?

George Harvey

A recent report in the journal Scientific Reports has been quite a topic of discussion lately (<https://bit.ly/Nature-end>). Basically, it says that even if we stopped emitting greenhouse gasses today, it would be too late to stop climate change, because we have passed the tipping point for methane emissions from melting permafrost. This has been controversial and has led to a number of articles asking whether we really are at the end of the world as we know it.

That "as we know it" part allows for a lot of possibilities. Some of them are doubtless well beyond unpleasant and ranging into the horrible. Some of them might be very different from what we know, but not any more unpleasant than

where we are now.

The question of what our future will be is very much up to ourselves. If we do nothing, we are heading toward a disaster. On the other hand, we may avoid disaster simply by being real.

The Scientific Reports article says changes will be big unless we start drawing down carbon dioxide (CO2) from the atmosphere now. Unfortunately, we are barely ready to do this.

Cont'd on p.37

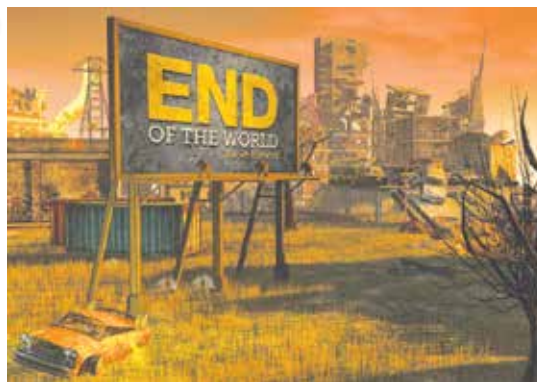


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OREGON FIRE BURNS STATE SENATOR'S HOME

Claire Cohen-Norris

This man is walking through what is left of his home that his parents built in 1968.

He is a state senator. He is one of the eleven state senators that walked out and hid so there would be no quorum and Oregon would be unable to pass climate legislation.

Here's the thing. Climate change is ruthless. It doesn't care whether you have worked to mitigate it, or whether you've personally pumped oil out of the ground.

It doesn't care. Because it isn't a political being. It is reality.

We can still prevent far worse. But we have to get really serious, really fast. Here's how.

- Always vote for people who accept science for what it is—reasoned conclusions based on observations.
- Next, do not buy anything that burns fossil fuels. Not a gas stove, not an oil furnace, not a gas-engine car. Every bit of infrastructure bought now must be clean-energy-based. Continue to drive your gas car and burn oil in your furnace, but do the research NOW, for how to replace them



Sen. Fred Girod walks through the remains of his home near Mill City, Oregon, on Sept. 13, 2020. Mill City, Gates and other towns along the Santiam River were all but destroyed by the Beachie Creek Fire and residents were forced to evacuate. "This was my forever home," Girod said. Photo: Brooke Herbert/The Oregonian.

with systems using clean energy. When the furnace or car dies, you will be informed and ready to do the right thing.

- Finally, figure out what policies you need to enable you to transition to clean energy and demand them. How sad that this now homeless state senator is still not facing the reality of the serious times he and we are now experiencing.

Claire Cohen-Norris is a climate educator and science teacher. She is the chapter leader of Citizens Climate Lobby Mid Hudson Valley West, based in Sullivan County, NY. ♻️

TO THE EDITOR: Your publication does an excellent job with key articles and many of global significance. I discovered it in NH and now receive it online. This allows me to share the issue or specific articles with many of our stewards. I also believe that a number are online subscribers. Please share with your team to keep up this excellent reporting.

– ACES - Newburyport, PO Box 281, Newburyport, MA 01950. www.aces-alliance.org. ♻️

RECOMMENDED DOCUMENTARIES

1. *A Life on Our Planet* by David Attenborough (<https://bit.ly/Life-on-Planet>).
2. *Kiss the Ground:* how soils can sequester carbon if we farm right. (<https://bit.ly/youtube-kisstheground>).

Reviews by Victoria Ines

A Life on Our Planet

You have benefited from biodiversity. From medicines and therapies to food, biodiversity plays an integral role in every single life on this planet.

I have always been fascinated by animals and their ecosystems. Every time a teacher offered a chance to research a self-chosen topic, I jumped at the chance to investigate more about them. But, as I did so, I slowly discovered the horrors facing each ecosystem, as well as the biosphere as a whole. Humans rely completely on healthy ecosystems to survive, but we are, unfortunately, sending biodiversity into a steady decline.

Through careless interactions with nature, people are biting the hand that feeds them. At 93, David Attenborough, the narrator of the documentary *A Life on Our Planet*, has seen the world decline from a wild place to a depressively tamed and industrialized world. But even as a young man, when the first picture of Earth was taken from space, he realized that "our home was not limitless. There was an edge to our existence."

As available space for animals and plants decreases, biodiversity is impacted as well. Humans have cut down three trillion trees and decreased the population of orangutans by two-thirds, just in the



last 60 years. Fishermen have reduced the large-fish population by 90%, and the world's coral reefs are turning white as a result of global warming. These are just some of the issues that Attenborough outlines in his documentary, but he makes it clear that they will not be the last. In the next 80 years, Earth will face devastations that we have never seen before. He calls this path, "a series of one-way doors... bringing irreversible change."

With these dire warnings, however, Attenborough also discusses solutions that could, if implemented immediately, reverse the damage that has been done to the natural world. His main

Cont'd on p.18

Concentration of CO2 in the Atmosphere

412.34

parts per million (ppm)
November 7, 2020

Learn more at www.co2.earth.

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VERMONT'S OPPORTUNITY FOR CLIMATE ACCOUNTABILITY

Johanna Miller

Earlier this year, for the first time, national polls were showing that climate change was a top issue of concern for many voters. The world has been upended in recent months, though, with the confluence of so many pressing issues – a global pandemic and public health crisis, a crippled economy, systemic racism laid bare, an historic election with immeasurable stakes – and climate change seems to have fallen off the radar screen for too many people. Nonetheless, with



An eighth grader from Burlington, VT makes a strong statement about the need for climate action — in solidarity with 1000s of others — at the September 2019 Vermont Climate Strike. Courtesy photo.

wildfires continuing to rage, intensifying storms and a climate-change denier in the White House, Vermont remains focused on needed action.

In late September, Vermont legislators successfully overrode Governor Phil Scott's shortsighted veto of a critical bill – the Global Warming Solutions Act (GWSA) – thereby turning the state's long-held climate action goals into requirements. The GWSA sets in place a planning and accountability framework to make strategic, pollution-reducing progress by 2025, 2030 and 2050; milestones similarly aligned with our neighbors in Maine, Massachusetts and New York, as well as nations participating in the Paris Climate Accord.

This foundational policy will help Vermonters move beyond drastically insufficient, incremental progress – which exacts high economic, equity and public health costs on all Vermonters – and roll up our sleeves to get to building a clean

energy future and ensure we do that work well.

The law outlines a clear set of principles to guide this effort, offering a path to a more sustainable, strong economy. Specifically, it:

- **Requires state-led, coordinated, thoughtful planning and action to reduce climate pollution and build more resilient communities.**

State government will be required to focus on this complex issue in a significant, integrated manner, ensuring progress and fostering the ability to draw upon

the expertise and innovation of Vermont's private sector in making this transition. This will be important to ensure that Vermont focuses on the tremendous economic opportunity in action, enabling us to make smart and strategic investments as we recover from Covid-19 and rebuild our economy, putting people to work in the climate innovation arena.

- **Requires the climate planning process to prioritize and identify climate solutions that reduce energy burdens for rural and marginalized communities.**

These strategies will focus on developing climate-resilient infrastructure, help communities adapt to the realities of a warming world, and increase access for lower-income earners to more affordable, 21st century, clean-energy technologies.

- **Recognizes the interconnection and opportunity in investing in Vermont's strengths – including its farms and forests – to realize pollution reduction and climate resilience benefits.**

Vermont's climate plan will capitalize on our existing assets like farms, forests and other rich natural resources in developing solutions for capturing and storing carbon.

To do this critical work, the law establishes a diverse, 23-member Climate Council and charges that Council with making recommendations, in the form of a Climate Action Plan, due in December 2021. The responsibility to advance the right suite of strategies to meet required targets and timelines, however, ultimately lies with the Vermont Agency of Natural Resources. And, Vermont lawmakers – elected by and in service to their constituents – will continue to play a lead role in enacting big policy reforms and, critically, legislators will also maintain control of the state's fiscal policy – crafting an annual budget, raising any potential new revenues, and more. This is, by the way, in contrast to the scare tactics of several opponents of this bill.

To ensure this work is done well and represents a broad cross section of key players and perspectives, the law requires the composition of four strategic subcommittees, focused on (1) resilience and adaptation, (2) mitigation strategies, (3) equity and justice, and (4) the role of our farms, forests and natural assets in this essential transition.

The Climate Council needs to be created and called to order this fall, so this new accountability framework is just getting underway.

And this fully focused, serious effort couldn't come a moment too soon.

Recently, when discussing options for costumes with my nine-year-old, I couldn't help but recall Halloween 2019; it was an oddly warm, intense rain storm that ended in a deluge of both water and tears. That storm caused massive flooding across the state and resulted in over \$5 million in damages.

The reality is ongoing, insufficient climate action only exacerbates the high costs we are already paying and will continue to pay for a warming world. Those costs include diminished quality of life, deteriorating public health and lost economic opportunity – not to mention leaving young people and future generations a far greater financial burden to bear.

As we collectively wrestle with a confluence of crises, there is hope and opportunity in the new Global Warming Solutions Act. With this concerted, strategic focus, we can recover in new, innovative ways that center and build equity, sustainability and a strong, local, clean energy and climate-friendly economy.

Johanna Miller is the energy and climate program director at the Vermont Natural Resources Council. Reach her at jmiller@vnrc.org.

Climate Change Disasters

Cont'd from p.1

back its residents learned that they would probably all have to move in the next 25 years because of a combination of land subsidence, due to oil being pumped out from under them, and rising seas, due to climate change. The second thing that makes Cameron Parish interesting in all of this is that 88.2% of its voters chose Donald Trump in the 2016 election. This year, Trump seems to have received 91% of the votes there.

More storms have followed Delta, each pushing the record for the number of storms in the hurricane season higher. Hurricane Eta hit Florida. And then came Iota, the most powerful storm of the 2020 hurricane season so far; it hit Nicaragua.

Though the hurricane season does not end until November 30, this year has already seen eleven named storms hit the U.S. coast. This sets a new record. The old record was eight, which was set in 1916 and tied in 2004.

It is not just named storms doing more damage because of climate change. We are seeing records set by weather events on land. There is no doubt that the people in Phoenix, Arizona have noticed a hotter year in 2020. On October 14, the city set a new record for 144 days in a single year with temperatures above 100°F. Fifty of those hot days had temperatures of 110°F or warmer.

While 1°C drives storms carrying more water over the seas, it also accounts for both higher temperatures and lower humidity through many inland areas. That combination dries out forests and wilderness. It also brings stronger winds. The result of parched land and high temperatures is that wildfires start more easily, and stronger winds spread them. We saw this earlier in 2020 in Australia, where January and February are summer months. Now, we are seeing it in the United States. As I write, eleven western states have had



Trees burning in the Creek Fire. C. Tolmie, CAL FIRE.

over 8.2 million acres burn. Very close to half of that amount is in California. (For reference, this is about 120% of the size of Vermont.)

Donald Trump said the western wildfires were the result of bad forest management rather than climate change. We might guess that he would blame climate change if he just stopped to consider that as head of the federal government, the majority of the land that burned was under his management. In some states, all of the fires burning as I write this are on federal land, according to the Center for Disaster Philanthropy (<http://bit.ly/CDP-fire-data>).

The increases of wildfire severity we have seen fulfill logical expectations that climate change will make them worse. Of the twenty largest wildfires in the history of California, from the time that accurate records started to be kept in 1932, three happened in 68 years of the 1900s. Eleven were in the twenty years from 2000 through 2019, and six have happened in the single year of 2020. Of the six largest wildfires in California history, five were all burning at the same time in 2020.

It is really surprising what global warming of just 1°C can do. And we probably have another 1°C coming, if we act moderately quickly. If we don't, it could be 2°C or even more. ☹️

Vermont Community Energy and Climate Action Conference

* Beginning December 5, 2020 *

Be part of Vermont's essential energy transformation!

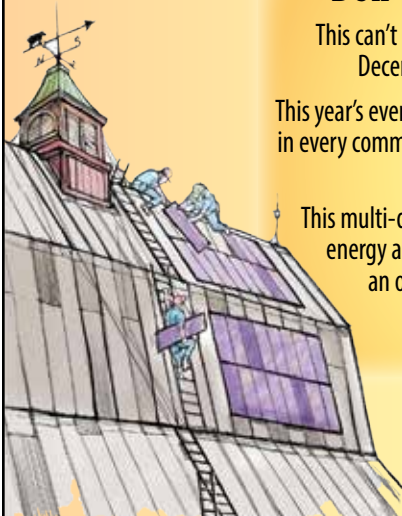
Don't Miss Our 2020 Online Event

This can't miss event will be hosted virtually this year, starting December 5th and continuing throughout the week!

This year's event centers and celebrates the critical role that Vermonters in every community play in moving our state to a more clean, efficient, affordable, and equitable energy future.

This multi-day event will begin by framing up the current state of energy and climate action with a deep post-election analysis and an overview of big, timely, potentially transformative opportunities, including the recently enacted Vermont Global Warming Solutions Act.

Register & learn more, including the schedule for the daily sessions at www.VECAN.net.



Top Electric Car Purchasing Questions Answered

David Roberts

Drive Electric Vermont has helped organize several virtual sessions on electric car purchasing and ownership over the past year. Here are answers to several of the most common questions that have come up during these discussions.

1. I live on a dirt road. Is the clearance too low on most electric cars for this situation? Are there any all-wheel drive all-electric cars with range of 150+ miles for under \$40K now?

Many electric vehicles (EVs) do have lower ground clearance to improve aerodynamics and increase range. However, there are growing numbers of "crossover" type all-electric vehicles which have more clearance. The most affordable all-electric, all-wheel drive (AWD) model currently available is the Tesla Model 3 which has a base price of \$46,900 for the long range AWD option before any incentives. There are many more models coming in the next two years, including the Volkswagen (VW) ID.4 which will offer AWD for an estimated \$43,675 before incentives. VW models are still eligible for the federal tax credit. For the ID.4, this could reduce the price by \$7,500 to \$36,175. In the meantime, shoppers may also want to consider some of the more affordable AWD plug-in hybrid models, such as the Subaru Crosstrek Hybrid, Mitsubishi Outlander PHEV or Toyota RAV 4 Prime to name a few.

2. Electric car technology always seems to be changing, is it better to lease or buy in this environment?

It depends on several factors that will vary depending on your individual circumstances. Leasing is a great option as it will roll in the value of the federal tax credit and protect against rapid depreciation seen on some EV models. It may not be a good fit for high-mileage drivers (over 15,000 miles per year) as leases typically include per mile charges if you go over the amount allotted in the lease

agreement. Some owners who know they may not be able to claim the full value of the federal tax credit will lease with the plan to purchase the vehicle at the end of the lease period. We have some additional discussion of purchase and lease issues on a Drive Electric Vermont blog post (<http://bit.ly/DEC-LeaseorBuy>).

3. Some EVs are advertised with more efficient heat pump heating systems, others rely on less efficient heaters. Does a heat pump improve winter driving range and comfort?

If you are running the cabin heat instead of the more efficient heated seats and steering wheel (common on many EVs, although may require outfitting with "cold weather packages"), then a heat pump will be less of a drain on the battery range. If outside temperatures are below 15 to 20 degrees F, then heat pumps often lose performance and backup resistance heating kicks on, so the benefit of a heat pump is reduced in frigid conditions. We have more information on which models include heat pumps and more tips for winter driving on our winter blog post (<https://www.driveelectricvt.com/winter>).

4. I have heard that there is a problem with dealers sending their used EVs out of state. What have you heard about this, and do you see any potential solutions?

When EVs come off-lease they are owned by the leasing company (usually a financing entity associated with the automaker, e.g. Nissan Motor Finance). The leasing company usually gives the dealer where the vehicle is returned the option to purchase the vehicle, so they can then offer it as a used model. If the dealer



Chevy Bolt. (Wikipedia)

doesn't do that, the vehicles are sent to out-of-state auto auctions. Vermont dealers do purchase from these auctions, but if they aren't seeing demand for used EVs they can be outbid by dealers from other states.

Many Vermont dealers have used EVs available, but as of 2020 there just isn't much overall supply. Quebec and several U.S. states are offering significant incentives on used EVs which can distort the market. As new EV sales increase, we expect to see more used options available in time. Some Vermonters have looked out-of-state to purchase used EVs and had them shipped.

We have more information and resources related to used EV purchase <http://bit.ly/DEVUsedEV>.

5. Are our utilities increasing their electrical capacity as increasing numbers of people go with all-electric cars?

Generally speaking, there is adequate capacity for thousands more EVs in Vermont, especially if they are charging during off-peak periods. Utilities are offering incentives for charging equipment that makes it easier to shift charging away from peak periods, which will help them sell

more energy through their existing infrastructure investments, which should help put downward pressure on electric rates over time. VELCO and electric distribution utilities regularly update long-range plans which factor in transportation electrification to ensure our utilities will be able to manage even large increases in EV use in the future.

6. Is Costco offering incentives for a Chevrolet Bolt purchase?

Yes, there is a special limited-time Costco program offering a \$3,000 Costco members-only incentive on a Bolt purchase or lease through Jan 4, 2021. Combined with other incentives this may result in lease pricing under \$200 per month. See <http://bit.ly/CostcoAutoProgram> for additional details.

7. When is the best time to buy a car?

Many automakers offer significant discounts and customer rebates on a month-to-month basis, so if you feel good about a deal you may not want to wait too long to take advantage of it. There are times of year when discounts tend to be higher (e.g. end of the month, end of the quarter, end of the vehicle model year), but discounts can vary significantly from one dealer (or auto manufacturer) to the next. Edmunds.com provides some additional information on timing your purchase at <http://bit.ly/BestTimeCarBuying>.

We were able to cover some additional topics related to EV battery life, charging and more in the full question and answer document from the virtual sessions available on the Drive Electric Vermont website: <https://www.driveelectricvt.com/webinar-ndew2020>

David Roberts is the Drive Electric Vermont coordinator. He has driven all-electric vehicles for the past eight years and says if you have to drive, drive electric. ♻️

Drive
Electric
Vermont

High Speed Supercharging Is in Vermont Now

Waitsfield, Vermont hosts new 30-minute charger

George Harvey

Some years ago, Volkswagen (VW) faced a dilemma. It could get its diesel engines to pass emissions tests, but only with a noticeable reduction in power. VW's leadership thought this would drive away customers. The company's solution was to build into the car's software a system that could detect whether the car was being tested for emissions. When it was, the emissions controls operated so the car could pass the test. Otherwise, the controls were bypassed, and the car was acceptably peppy. This meant that the car produced up to forty times as much pollution as it should have, nearly all the time.

VW's scheme was discovered, and the attorneys general of a number of states, including Vermont Attorney General T.J. Donovan, brought charges of fraud. The prosecution was successful in 2017. VW pleaded guilty and agreed to pay settlement money for the damage it had done.

This is an important issue. A study by the American Lung Association in California found that air pollution from all transportation cost Vermont \$313 million per year in health costs. VW's fraud was a part of that cost we did not need (<https://bit.ly/ALA-study>).



A super-fast charger was installed by SunCommon at Mad River Taste Place in Waitsfield, VT. It has a capacity of 62.5 kilowatts, which can charge many EVs in half an hour. The power for the EV charging station is provided from a community solar array. Image: Mad River Taste Place.

Vermont received \$6.5 million in the settlement, and leaders in the legislature decided to use the money in ways that

would reduce pollution from transportation in the state. Money from the award was used for the Vermont Electric Vehicle Supply Equipment Grant Program to install charging stations for electric vehicles (EV) at eighty sites.

Recently, a super-fast charger was installed by SunCommon at the Mad River Taste Place in Waitsfield. A casual observer might ask why a small town like Waitsfield would be chosen as a charging site.

After all, it would probably not be included in a list of transportation hubs. The region, however, is very popular with tourists. The

area is home to two important ski resorts, Mad River Glen and Sugarbush Resort. The river itself also has some areas popular for swimming.

Mad River Taste Place is a popular location for tourists to pick up products of local Makers and Growers. Its co-president, James Moore, said, "SunCommon is building Vermont's clean energy future with many hundreds of solar arrays, storage batteries and electric vehicle charging stations. We're thrilled to have built this latest one, the state's fastest charging station yet, to delight local residents and visitors to the Mad River Valley alike." (We recommend checking the website, www.madrivertaste.com, to see about hours and what is available during the Covid-19 pandemic.)

The charger in Waitsfield has a capacity of 62.5 kilowatts, which is sufficient power to charge many EVs in half an hour. SunCommon, which installed it, is the largest provider of residential, community, and commercial solar systems in Vermont. The power for the EV charging station is provided from one of SunCommon's community solar arrays in Vermont, and the company's 8,000 Vermont customers will be able to charge their cars at a discount. ♻️

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 car-pools, 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 advance 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 HOW AND WHY OF LEVEL 2 CHARGERS

Randy Bryan



Image: seneedhome.com

First, happy holidays to all. I hope you have a wonderful time while staying safe and healthy.

Now onto electric vehicles (EVs). You've probably heard the statistic that 80% of EV charging will happen at home. Well, given the 150-350-mile range of most EVs, the 20-50-mile range of most plugin hybrids, and that most people drive an average of about 40 miles per day, it makes sense that most charging will happen at night, at home, so the car has a full battery each morning. Since the early EVs were on the expensive side, the early adopters had above-average incomes so were likely to have off-street parking with electric access. Hence, they could charge at home.

But, many potential owners might live in multi-tenant complexes without electricity available at a dedicated parking space, and a property management administration to convince to make the needed changes. All this means that the cost and fun advantages of EVs would be unavailable to many potential owners.

What to do? In the short term, having commercial fast charging available around the state is priority one. New Hampshire sorely lags in this development but is working hard to catch up. Even so, fast charge locations may be inconvenient (50-70 miles between locations) for everyday use and can be expensive (2-3 times the cost of residential electricity).

More ubiquitous, privately funded, lower cost (Level 2) chargers are needed. These chargers take hours to charge a car, not tens of minutes. The best places to put them are where people leave their car for hours at a time, and where electricity can be made available curbside. Good examples are businesses, public garages and parking lots, airports, train and bus stations, hotels, shopping malls and even some restaurants. Where cars stay for multiple days at a time, smart 110-volt sockets may be a good solution. In the case of retail outlets, simply attracting EV drivers can reap more rewards than parking fees.

Still, you've got to have outdoor, rugged charge stations or sockets linked to kiosks for enabling and disabling the stations. The bad news is that these stations can be expensive, and this charging often happens in the middle of the day when other electrical demand is highest and more expensive (i.e. may be 2-3 times the normal residential rates).

The best option is to provide charging service and equipment convenient to where people sleep, in this case, for multi-tenant buildings and complexes. They need parking and charging close to home and at costs that

are comparable to residential rates. For some places, the needed wiring-to-station installation can be made easily. But in many cases, this can be more complex and expensive, dealing with city public works, or a building management association plus the utility and expensive buildout costs. Heavy duty wiring needs to be brought to the parking area and to multiple substations. Then, wiring to each parking space needs to be installed. Someone has to pay for this, and multi-tenant places have to deal with resident turnover. Not many plugin cars need to be accommodated at the start, but the whole setup needs to be expandable over time. Recall Tesla and Volkswagen have declared that they will produce affordable cars in massive quantities by 2025 (others to follow), and California just declared that no more new gasoline vehicles can be sold in-state after 2035. Change may come faster than you thought.

The equipment for these multi-tenant installations is still evolving and the manufacturers are coming up with better solutions, so I rate this area as good and getting better. But getting a parking lot ready for charging (wiring to substations and around the parking lot) needs better solutions (really policies) than are present in New Hampshire, so far. Other states have already come up with solutions that New Hampshire might consider. I'll mention two of the most useful: One answer is through building codes. New (or highly renovated) complexes must pre-install the basic cabling to substations and parking spaces to accommodate resident charging. This is a very minor cost if pursued when building out, yet the benefits can be huge and long term. The other answer needs to come from the utilities. A pledge to install the cabling infrastructure to these complexes' parking lot substations and recoup the costs long term needs to be made. It's called 'Make Ready' and it's sorely needed.

If these policies are not on your radar, they probably should be. Think about it. If we don't keep up with surrounding economic markets, tourism will suffer, job recruiting will suffer, and New Hampshire and its residents will miss out on the internal economic gains that electric cars bring over combustion cars.

Enough said. Please vote. Stay healthy. Enjoy the holidays.

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

VERMONT LAW ENFORCEMENT GOING GREEN

Jessie Haas

The Vermont State Police, Vermont Department of Public Safety (DPS), Brattleboro Police Department (BPD), and Windham County Sheriff's Office are all experimenting with electric or hybrid vehicles, hoping to save on fuel and maintenance and to reduce their environmental footprint.

Of the three departments, the State Police are making the largest purchase, three Ford Hybrid vehicles for direct police use. DPS is purchasing two hybrid vehicles for civilian members of the Department. BPD has also requested the Brattleboro Select Board to authorize the purchase of a Ford hybrid. The Ford hybrid is not electric-powered while going down the road. Instead, it uses its large battery to power heat,

air conditioning, emergency lights, and other equipment, and especially to reduce idling. Since a BPD vehicle averages four hours of idling a day over two eight-hour shifts, this represents a large fuel savings, approximately 380 gallons a year. A gallon of gas releases roughly 19 pounds of CO2 when burned; Brattleboro's vehicle alone could prevent the release of 7,220 pounds of carbon a year, 28,8000 pounds over the



Windham County (Vermont) Sheriff, based in Newfane, has purchased a Tesla Model 3 to replace one of the Department's cruisers. Photo courtesy of Sheriff Mark Anderson.

projected four-year life of the vehicle.

The Ford hybrids are not pursuit-rated vehicles, and won't be used by road troopers. Currently manufacturers don't make such a vehicle.

Separately, the Windham County Sheriff, based in Newfane, has purchased a Tesla Model 3 to replace one of the Department's cruisers. Sheriff Mark Anderson regards this as a pilot project, and it is one

molded by the unique conditions of the 2020 pandemic. Normal vendors of police cruisers—Ford, Chevrolet, and Dodge—have delayed production until 2021; the vehicle Anderson is replacing is estimated to need \$7,000 in repairs to keep it going that long.

Alternative energy vehicles had been on Anderson's mind, so he contacted Tesla and learned that he could get a car in four to six weeks. The numbers worked. No oil changes are needed, no gas to purchase, a four-year, 50,000-mile warranty on the car, and an eight-year, 130,000-mile warranty on the battery and drivetrain. Though the initial purchase price was \$47,990, considerably over the \$40,000 Anderson had intended to spend, the savings per mile were also considerable; three to four cents for electric vs. ten to twenty cents for gas. Anderson's analysis showed that the Tesla could save approximately 80% of the costs of running a gas vehicle, typically between \$4,000 and \$8,000 per year.

Like the Ford hybrids, the Tesla will not be used as a pursuit or patrol vehicle initially, as the department learns about what changes are needed to the culture, infrastructure, policy and training. It will have police lights and a radio, and will be capable of responding to calls.

The car is generating some excitement in the area. Anderson has had many conversations about it, including having people say they'd be interested in working for the department solely because of the Tesla. He is currently working with Green Mountain Power to get a level 2 electric vehicle charger installed. While initially intended to charge the department vehicles, the department is open to a conversation

with the County, Town and Village about hosting a public charging station.


Anderson is the first sheriff in the nation with a Tesla, and only twelve police departments are known to have put Teslas into active service. Anderson regards this as a pilot program and doesn't expect to replace all his vehicles with electric yet. "Law enforcement has a high demand on automobiles and to find a way to reduce our carbon footprint is big," he says.

Special thanks to Bob Audette and the Brattleboro Reformer for their reporting on this story.

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Vermont. ♻️

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SUSTAINABLE TRAINS AND PLANES

Jessie Haas

Transportation is one of the most persistent sources of greenhouse gases (GHG) and one of the most difficult problems to solve. But recently some countries have been making strides, with both electric and



Hydrogen-powered passenger train Image: Alstom.

hydrogen fuel-cell-powered mass transit.

In Europe, where most countries take their obligations under the Paris Accords seriously, hydrogen fuel cell-powered trains are beginning to make inroads. Since September 2018, two Alstom iLint trains have been used in northern Germany, each carrying 150 passengers per trip. More hydrogen trains are scheduled to come on line in 2021-22 in Lower Saxony, which projects having 27 hydrogen trains by the end of that period.

The trains use hydrogen fuel cells instead of overhead electrical wiring. The power modules are located on top of the train. They extract oxygen from the ambient air, while storage tanks supply the hydrogen. The only emission is water vapor. The iLint trains have a range of 1000 kilometers per hydrogen tank fueling, which matches the miles-per-fueling performance of conventional regional trains. They reach a top speed of 140 kilometers


per hour and are much quieter than diesel trains.

Similar trains are being tested in the Netherlands and the United Kingdom (UK). A train called the Hydroflex, developed by engineers from

the University of Birmingham and the British rail company, Porterbrook, currently houses its hydrogen tanks, fuel cells, and batteries inside the passenger cars, though the future plan is to site them underneath the train in high-pressure tanks. The UK has 42% of its route miles electrified; adding hydrogen trains to the mix offers a conversion to green transit at a lower cost, as they don't require massive track overhauls and can be created by retrofitting existing diesel trains. Cost is an especially important factor for rural areas, with more miles and fewer passengers. Hydrogen trains are only as green as the fuel used to create the hydrogen. Currently the cheapest way to do that is with natural gas, but photovoltaics are a possibility, and areas with an excess of offshore wind are already planning to go into hydrogen production.

India plans to electrify its entire rail system by 2030, reducing carbon emissions to zero. They plan

Cont'd on p.7




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ELECTRIC SCHOOL BUSES ARE A BIG SOLUTION

George Harvey

Nuvve Corporation is a green energy technology company based in San Diego that bills itself as a leader in vehicle-to-grid (V2G) technology. Blue Bird is America's largest producer of school buses. Now, the two have entered into a partnership to bring America up-to-date, with electric school buses.

Blue Bird actually pioneered the electric school bus. Its first electric model was introduced back in 1996. But up to now, electric school buses have been pretty much in an unusual niche.

Today electric buses have a large number of advantages. They do not emit carbon dioxide on their own, and if their electric supply is a low emitter, then their net contribution is minimal. They do not expose school children to diesel exhaust, which is a real health hazard. They are quiet. And despite the fact that electric buses have higher up-front costs than diesel or gasoline equivalents, they are so much cheaper to run so they save a lot of money.

The partnership of Nuvve and Blue Bird, however, brings another big advantage. With V2G technology, they have a potential to reduce bills for every electric utility customer.

The trick to the grid is keeping things in balance. Baseload power plants are inflexible, always generate the same amount of power. But the supply changes constantly, so we have had to use expensive electricity from plants that can change their output.



Electric bus by Nuvve and Blue Bird. Nuvve image.

Some of these can match demand changes in just a few minutes.

With renewables, we have equipment that has constantly changing output, and this has its good points, as well as some that are not so good.

Baseload power has been used because it was cheap. Peaking plants, by contrast, might produce power that costs the utilities five times as much or more. The economic balancing act they have to maintain has been hidden from consumers, unless they want to be involved.

Now, we are entering an age when batteries are being used more and more. They can respond to changes in demand in amounts of time so short that the grid can be balanced constantly, for all practical purposes. And that has the potential to save utilities and consumers a fair amount of money.

This is where the partnership of Nuvve

and Blue Bird can have an effect on our economy. V2G technology means that vehicles can provide electricity to balance the grid. And this reduces the need for utilities to invest in battery-backup power greatly.

The idea that a bus or a car can discharge a little power might not seem like a big issue. But consider this: There are 480,000 school buses in the United States. Each of these might have a 150 kilowatt-hour battery, which is not all that big, but if 480,000 were combined, that would be 72,000 megawatt-hours. And that is just a little bit shy of the average amount of electricity produced in an hour by all the nuclear power plants in the country.

If that is available to our utilities, it would push our power bills down a lot. And that will happen if we all decide to reduce pollution, noise, and costs. ♻️



Power out!

PlugOutPower.com

LARGE ELECTRIC BUS FLEETS

G.E.T. staff

What city has the biggest fleet of electric buses in North America? Toronto, of course!

The Canadian federal government is too smart to follow in the footsteps of the U.S. where the lack of federal leadership had been shown in recent years.

Toronto has received \$140 million for transit work (equal to about \$108 million U.S. dollars).

Part of what it has done with that was to buy 60 electric buses. Of these, 35 are in service, and 25 are being tested before service.

But Canada is not alone at moving in the right direction for our future. Take a look at what China is doing:

By way of comparison, there are over 16,000 electric buses operating in the Chinese city of ShenZhen.

We hope that the USA will soon follow this path to not only keep our children safe on their way to and from school, but to help in our fight to reduce our emissions and for their future. ♻️

SUSTAINABLE TRAINS AND PLANES – Cont'd from p.6

to use land alongside the tracks to install solar arrays. The Indian rail system is the third largest in the world, behind the U.S. and China, carrying eight billion riders and 1.2 billion tonnes of freight a year.

In the U.S., the biggest bang for the buck would be converting freight trains to hydrogen fuel. However, freight is typically heavier than passengers, so more space is required to store hydrogen.

Are hydrogen-powered trains even a good idea? "I think it is too early to tell," said Christopher Parker, executive director of the Vermont Rail Action Network. He believes that further research is needed, and the European experiments may provide useful information. What's important is "getting the technology right and creating a product that is reliable and not too expensive. Getting ahead of ourselves means the technology would not get a fair trial and risks being abandoned prematurely."



In 2016, Solar Impulse 2 was the first solar-powered aircraft to complete circumnavigation of the world. Wikipedia.com

He pointed out that rail is already three times more efficient than driving and favors better land use. "Reliability is more important than fuel source because that is critical to wooing people from their car. The biggest improvement in sustainability could come from using self-propelled railcars instead of locomotives. I favor electricity (as a fuel-source) but realize that overhead wires double the sunk cost of in-

frastructure (a big challenge in a rural state with infrequent service) which causes me to wonder if there is a case to be made for routing high-voltage power lines down rail corridors to share the cost of poles, etc."

Meanwhile, strides have been made recently in electric commuter planes. A retrofitted Cessna Grand Caravan nine-passenger plane had a successful test in May 2020 in Washington state. The Grand Caravan is a popular mid-range commuter airplane. The plane is nearly silent in flight, is expected to be up to 80% less expensive to operate and will need far less maintenance.

Really, though, in a world which, as of this writing, is bracing for a second wave of the coronavirus, sustainable travel may seem a trifle academic. None of us should be going anywhere, period. And this, in fact, is the greenest form of travel. Just as the greenest watt is the one you don't use, the greenest trip may be the one you avoid. As businesses locked down worldwide this year, telepresence expanded massively. It isn't seamless or perfect, not everyone loves it, and it's not without energy costs; those devices all use electricity. But it's always been easier and more cost-effective to green a stationary grid than a

moving vehicle. In fact, telepresence was identified by Project Drawdown (<https://drawdown.org/>) as #63 in its hierarchy of global warming solutions, with an estimated reduction of 1.99 gigatons CO₂ by 2050. This comes at a \$127.7 billion cost, and a \$1.31 trillion in net savings. This also results in 82 billion fewer unproductive travel hours.

Many of our fellow global citizens are experiencing this change already. Adoption was considered the biggest barrier to telepresence; Covid-19 forced adoption overnight. Drawdown (<https://www.drawdown.org/>) noted, "More and more, we will be able to go to work without going anywhere at all, and potential carbon emissions will stay put, too." According to an article in Bloomberg Green, working at home and online shopping will reduce driving in the U.S. by up to 270 billion miles a year.

Source links available on our website. ♻️

Off-Grid Solar Installations Increasing During the Pandemic

George Harvey

The Covid-19 pandemic has had different effects on different industries. Some industries have been hit hard, and others found the time exceptionally profitable. We wanted to get a good idea of what is happening for the solar industry, and so we contacted Darren O'Meara, one of the managers of O'Meara Solar in Orange County, Vermont.

"We have done the most off-grid that we have ever done in a single season," O'Meara said. "We have had a sort of market boom." He described the systems as being on the large end for off-grid homes. They range from two to five kilowatts (kW).

The off-grid installations fell into two groups, and for two different reasons.

One group has people in new homes in remote locations, far from the nearest grid connection. The cost of building electric lines to such places can be prohibitive. In the past some houses were not built because of the high cost of electricity.

Nowadays, the cost of solar power with batteries has fallen to the point that it is competitive even for homes that are relatively close to the grid, and it has turned remote

areas into places that are attractive for building.

The Covid-19 pandemic has created a more immediate need for off-grid solar systems. Many people who have some extra money own cabins in rural New England. Many of these people live in areas that have been hit hard by the pandemic, and so they have been looking at alternative places to stay. It happens that Vermont has the lowest rates of infection and death from Covid-19 of any state (<https://bit.ly/2HyHL4a>). This makes Vermont an especially attractive place, especially for older people or those in other vulnerable health groups.

Because of this, many people are building off-grid solar systems for what had been cabins, with a view to spending much more time in them. We would hope that

they are insulating and weather-proofing the cabins at the same time.

Where people select installations in the range of two to five kW depends largely on the size and use of the homes. For a single, rather frugal person who is heating with wood, two kW is often more than enough. For a family with a central heating system, five could be a better bet.

Asked about solar power in Vermont in

general, O'Meara said it has declined since 2017, but he also said, "I don't have a philosophy about why that is." He did say that Vermont may be suffering a little from its own success, because the first flush of easily installed systems were all in place at just about the same time that solar power started picking up elsewhere.

One thing O'Meara wanted to make clear is that customers have to be prepared to deal with how off-grid solar systems are different from grid power. Straight grid power is rather easy to deal with. The utility supplies electricity and the customer pays for it. For the customer, things usually do not need much thought.

By contrast, an off-grid solar system requires a certain amount of attention. People have to understand such things as battery life and how they can improve it to get the best performance from their system. O'Meara recommends that people keep logs of such things as voltages and kWh readings on a daily basis. This is especially important because it means the person operating the system can notice any deviation from normal operation.

O'Meara said he uses Q Cell solar panels and LiFePO₄ batteries from Simpliphi or RELION along with Magna-Sine inverters and Midnight charge controllers. He said he is reluctant to take on untried products



Commercial grid-tie array at Rek-Lis Brewing in Bethlehem NH. Photos Darren O'Meara.



Inverter and batteries for a local off-grid installation.

until they are proven in the field.

It is clear that other installers have had different experiences with solar installations in the time of the pandemic. The question of whether the rate of installations has changed is tied to a number of factors. We might note that all U.S. electric capacity installed in June, July, and August was renewable, according to the Federal Energy Regulatory Commission. And 52% of what was installed in those months was solar.

Learn more at O'Meara Solar's website at www.omearasolar.com.

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Going Solar (Plus Storage): A VT Homeowner Shares Her Experience

By Janice Ouellette, Clean Energy Group

My husband Dan and I feel very fortunate to live in the "Green" Mountain State of Vermont. In recent years, programs have emerged that have brought clean, renewable and affordable energy to the residential sector in the form of solar PV plus battery storage.

Our path to solar plus storage has been a two-stage process, beginning in 2017 with our decision to go solar. That summer we heard about a presentation to be given at a local restaurant by a Vermont solar installation company, SunCommon. We have long-been environmentally conscious, being avid recyclers and owning a hybrid vehicle, so our interest in solar was piqued. What we heard at the presentation convinced us of the financial benefits of installing solar panels through net metering with our electric utility, Green Mountain Power (GMP). At the time, the federal tax credit available was 30 percent; the panels could be purchased up front, with a cash discount, or financed with our local credit union, VSECU, for 12 years at a low interest rate. With the financing option, the tax credit received would be used to pay down the loan. We walked out of the presentation excited about the upcoming site visit that



The Ouellette home features 27 solar panels along with two Powerwall batteries. Courtesy photos.



we had scheduled.

The site visit involved taking a deeper dive into cost savings, by taking into account our annual outlay for electricity and the payback period for the cost of the panels. We were also given estimates of the number of panels necessary to power our home under various options, including the addition of air source heat pumps. In the end, we opted to have 27 PV panels installed in a rooftop mount, adding a

few extra panels for a heat pump to supply heating and cooling to an area of our house heated with propane. The net cost, after the cash discount, design rebate and the 30 percent federal tax credit was \$21,150. Our annual outlay for electricity at the time was \$1,600. After two full calendar years of solar power, we are saving

about \$1,400 annually in electricity costs, and we have not exhausted the solar credits in our net metering bank. Given this, the payback period for the net cost of the panels will be about 15 years. Solar panels will generate at maximum energy production for a period of 25 to 30 years, after which production will decline significantly. This will result in an additional cost savings of between \$14,000 to \$21,000 dollars over the lifetime of the system. Our investment will more than pay for itself with the added benefit of increased re-sale value of our home.

Two years after our solar panel installation, SunCommon contacted us to let us know about the Resilient Home program being rolled out by GMP. GMP was offering its customers a great deal on two Tesla Powerwall batteries. Buying into the program would allow our PV panels to work in tandem with the batteries, providing electricity to our house when the power grid was down. A double Powerwall system retailed for about \$22,000; GMP would lease the system for either \$30 per month for ten years, or one up-front payment of \$3,000. Installation would be free as our house had the 200-amp service necessary to the system, and any warranty issues and maintenance would be the responsibility of GMP as owner of the batteries. An integral part of the program was

sharing the stored energy with GMP, allowing them access the batteries during peak power events – which will also help to bring down electricity costs for other GMP ratepayers. Any energy used by GMP would be deposited back in our net metering bank at a higher rate. Living in a rural area with many trees around the power lines, where power outages are not uncommon, this offer was too good to pass up.

Our Powerwalls were installed in January of 2020. To date we have experienced one brief outage. Our batteries kicked in immediately with no interruption of service and no need to reset clocks or timers. In the event of an extended outage, our Powerwalls will provide electricity for 16 to 24 hours; longer with careful energy use and sunshine to allow our panels to concurrently charge the batteries. When a weather event is forecast, GMP takes care of customers by ensuring the batteries are fully charged and ready to go.

Dan and I feel so fortunate to have been able to take advantage of these clean energy programs, but more importantly to live in a state that is committed to renewable energy. Here, solar installation companies, utilities and financial institutions partner to bring resilient power to Vermont's residents, so that together we can all benefit.

Janice Ouellette is the Bookkeeper and Human Resources Assistant at Clean Energy Group, based in Montpelier, Vermont.



Editors note: GMP's Powerwall offer is currently full but reopens in January 2021. Enroll now at <http://bit.ly/GMP-PowerwallOffer> to get on the waiting list. ♻️



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Vermont Solar Expands State's Pollinator Habitat

Renewable Energy Vermont

This summer marked a major milestone for Vermont solar's collaborative efforts to restore pollinator habitat in our state. In July, Middlebury-based REV Member, Bee the Change teamed up with REV Member Green Lantern Solar to install its twentieth pollinator-friendly solar field on a 4.5 acre site in New Haven, Vermont. The site will host dozens of species of plants designed to attract native and migratory pollinator insects and beneficial bird species.

Prior to REV's pollinator solar pledge in 2017, most Vermont solar fields were covered with hay or turf grass. Following guidance from biologists at UVM Agricultural Extension, the Gund Institute for the Environment and Vermont's Agency of Natural Resources, pollinator-friendly projects now utilize land under solar arrays and power lines to create habitat for native pollinators. Pollinators are a crucial part of any ecosystem, and their decline has spurred action across many sectors, including Vermont's robust renewable energy sector.

Mike Kiernan, founder of Bee the Change celebrated the accomplishment. "We are teaming up with the most forward-thinking renewable leaders who want to see the space be doubly useful, to address both climate change and the crisis of species loss. We



Mike Kiernan of Bee the Change plants in the solar fields. Photo courtesy Mike Kiernan.

began a few years ago in a field just south of Middlebury. With the spaces coming on line in the next year, we will have built habitat equivalent to every Vermont household making a six-foot by six-foot pollinator garden. And they should, too!"

Habitat loss is one of the principal reasons pollinator populations are near collapse worldwide. As parking lots, residential lawns, sprawl development and roads take over meadows and woodlands where native species once thrived, our pollinators struggle to find the resources they need. A 2018 study by researchers at the University of Vermont and the Vermont Center for Ecostudies found that nearly half of Vermont's known bumble bee species have either vanished or are in serious decline. The Agency of Natural Resources encourages Vermonters to take action by choosing to plant a variety of

native plants and wildflowers wherever possible.

Several Vermont businesses and organizations have committed to pollinator-friendly practices, including REV Members Acorn Energy Co-op, Aegis Renewable Energy, All Earth Renewables, Catamount Solar, EDF Renewables (formerly GroSolar), Encore Renewables, Green Lantern Group, Grassroots Solar, Green Mountain Power, and VSECU.

Sam Carlson of Green Lantern Solar, described his company's recent collaboration with Bee the Change. "We have seen increasing populations of insects, birds, bees and butterflies over the past three years at our first solar project with Bee the Change. We wanted to build on the success of our first project with Bee the Change and demonstrate that solar projects in Vermont can and do improve pollinator-friendly habitat, which is so vital to Vermont's agricultural productivity and landscapes. In this way we produce both clean, Vermont-made solar electricity and increase critically important pollinator populations, a great use of the land."

Pollinator-friendly planting is part of a win-win-win strategy for Vermont solar projects and landowners, supporting clean energy, agriculture, and pollinators. By using the land under and around solar arrays for native pollinator-friendly plants, Vermont solar energy can play a significant role in re-establishing critical pollinator habitats and mitigating the threat to


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bees and birds, which are essential crop pollinators.

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Cont'd on p.19



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Non-Profit Businesses Benefit from Solar Generation

George Harvey

A tax incentive reduces a tax bill. Obviously, the tax bill has to be big enough to make it attractive to reduce it. And obviously, that means that tax incentives are directly useful only to people or organizations that have sufficiently large taxable incomes. That might sound backwards. After all, it is those without much income who really need to benefit. But let's be clear on two things. First, whoever pays for solar photovoltaic (PV) installations has to have money to spend. And second, we need to deal with climate change, and a solar system can benefit everyone by helping with that.

It happens that there are also ways for organizations that do not pay taxes to get their solar power. These organizations can be municipalities, schools, churches, other non-profit organizations, or even community systems set up to reduce the electric bills of people on low incomes.

We talked about this with Kim Quirk, the Branch Manager for ReVision Energy's location in Enfield, New Hampshire. The first thing Quirk said was, "We get excited working with non-profits. We are a benefit corporation, and we are mission-driven." Then she outlined three ways she has seen solar

The least expensive source of electricity available today is solar power.

PV systems set up for non-profit organizations.

The first of these is simply to have a donor give an endowment, motivated by concerns for both the environment and for the non-profit itself. Tax credits are not necessary for this. Setting up a PV array for an organization provides a gift of both with "decades of free electricity," in Quirk's words, and knowledge that the electricity is also free of harmful environmental side effects.

A second method involves finding a combination of donations, grants, and loans to assure

that the non-profit has costs reduced from what an electricity bill would be. Paying down the cost of a solar array is less expensive than buying the amount of electricity it produces. And the debt can be set up so at the end of its term, the PV system can be transferred to the non-profit for a nominal fee, providing free electricity for many years after that, perhaps decades.

A third way to get renewable energy to larger non-profits, municipalities, and school systems, is through power purchase agreements (PPA). Under such agreements, the electricity can come from renewable resources at costs lower than normal grid power. The least expensive source of electricity available today is solar power, and the least expensive way to get started for non-profits and mu-

nicipals seems to be coming from PPAs for solar power. Under the agreement, it is provided at a fixed price, day or night, year around.

A catch to the PPAs is that the project needs to be large enough system to make the numbers work for the investor, and this might mean that it must be 100 kilowatts (kW) or larger. We should bear in mind, however, that the overall system does not have to provide all of its output to a single user. Group net metering allows for multiple organizations to share the production from one large solar array.

Investors who prefer to put their money to work in ways that benefit causes they want to promote are called "impact investors." These investors help with needs almost anywhere, and for individuals or groups of people. The trick, however, is to find them. And fortunately for those who need to find impact investors, ReVision has a program in place to help non-profits and impact investors find each other.

There are a number of examples of non-profit organizations that benefited from one of these options. Solar PV not only benefits a business, but also benefits all of us by reducing greenhouse gas emissions while reducing power bills for other utility customers by reducing peak loads.

Kim Quirk also said something that is worth repeating, "We cannot make things better until we have first stopped making them worse." We cannot fix everything all at once, so we must fix things one step at a time. Every PV installed is another step toward dealing with climate change.

In addition to the arrays pictured, a few of note are Woodlands at Harvest Hill in

Lebanon, NH, which has a 180-kW solar array on the roof, saving \$24,600 per year; the First Parish Church in Milton, MA; the Nashua Police League in Nashua, NH; and Graylag Natural Preserve in Pittsfield, NH.

ReVision Energy has offices in Maine, New Hampshire, and Massachusetts. The company's web site is www.revisionenergy.com. ♻️




Top: Claremont MakerSpace has a 57.9-kW solar system, with savings of \$7,100/yr., that offset approximately 28,732 lbs of CO₂ emissions per year. Claremont Soup Kitchen has a 27-kW solar, saving nearly \$3200/year. The solar panels follows the curve of the roof. Photos: ReVision Energy.



Top left: The Children's Museum of NH and adjacent Dover pool have a 101.76 panel rooftop solar system. There was no upfront cost to the city of Dover because of a power purchase agreement (PPA). Bottom left: The Nashua Police Athletic League rooftop solar was made possible by nearly \$50,000 in donations. It is projected to save \$100,000 over 25 years. Above: The Phillips Exeter Academy, in Exeter, N.H. has one of the largest school solar arrays in NH. The 1,552 solar panels are expected to save the school \$2 million over their lifetime.



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Enlarging New Hampshire's solar systems – in the field and on the roof

George Harvey

New Hampshire has a reputation of being slow when it comes to the uptake of solar power. The goals have been set, it seems, but some of the state's utilities appear not to be particularly interested in pursuing them. Net metering is allowed, but it is limited to systems that are much smaller than those in other states in the Northeast. That may be changing, however.

Just about three years ago, a new solar array was commissioned that set a New Hampshire record for capacity. That was the Moultonborough solar array, which has 8,000 panels on twelve acres. It has an AC capacity of 2.0 megawatts (MW). At the time that it started operating in December of 2017, it was the largest solar array in the state. The New Hampshire Electric Cooperative (NHEC) regarded it as an investment that would help it learn about how to deal with renewable energy in the distribution system. But the story did not end there, as we shall see.

The Moultonborough array did not hold the record long. In June of 2018, that record was surpassed by an array put up in Merrimack for Fidelity Investments. That array has a capacity of 3.1 MW, which covers 16% of the electricity needed for an office building with one half million square feet of floor area. The array fit into Fidelity's 13-point sustainability plan.

Those two arrays are both ground-mounted. New Hampshire also has been seeing increasingly big rooftop solar arrays, and it happens that ReVision Energy is just now finishing the largest of these in Londonderry on the roof of a building owned by Bellavance Beverage Co. This array has DC capacity of 1.16 MW, and it is expected to be operating in December 2020.

These arrays have come at a time when solar photovoltaics (PV) are starting to grow very quickly. And the difference is getting magnified. The big and bigger are not being followed by something that is merely biggest. A new array NextEra Energy is building in Fitzwilliam does not represent stepwise growth from the current record of 3 MW to something slightly bigger. It is



The Bellavance Beverage Company in Londonderry, NH hosts the state's largest rooftop solar array. Rooftop image courtesy of ARCO/Bellavance Beverage Co. Inset is the celebration of the completion of the 1.16 MW DC solar installation by Revision Energy. Courtesy image.



growing by making a broad jump from 3 MW to 30 MW.

It might be a good idea to look briefly at NextEra. Not all that many years ago, NextEra, a Florida utility, was best known to people in New Hampshire as the owner of the Seabrook nuclear power plant. It was also not all that long ago that the biggest publicly traded company on Earth was ExxonMobil.

Since that time, ExxonMobil has lost market value, as it lost money on oil and gas. But, NextEra has been investing heavily in renewable energy, and it has been gaining value rapidly. Now, NextEra's market value has passed that of ExxonMobil. (Prices of each go up and down, so they can pass each other more than once.) In fact, NextEra owns PV arrays in 26 states.

NextEra has looked into a number of sites in the Northeast to build solar farms. After identifying the Fitzwilliam site as a place it wanted to build its Chinook Solar array, it found that ReVision Energy would be its best candidate to build it. And so, the project has moved forward. It will take up about 100 acres of land.

Chinook Solar is the first solar project in New Hampshire big enough to require approval by the state's Site Evaluation Committee (SEC). The SEC reviewed the project for two days in a virtual meeting, during which it considered such questions as finances, engineering, environment, and aesthetics. They considered whether the project was in the public good, and how it would impact the region's development. They made some

modifications to the plan, particularly relating to protections for endangered species while the plant is under construction and to how the project will be decommissioned. Ultimately, the Chinook Solar project was given unanimous approval. It is to be under construction soon, and it is expected to be commissioned by the end of 2021.

Fitzwilliam is in Cheshire County, in the

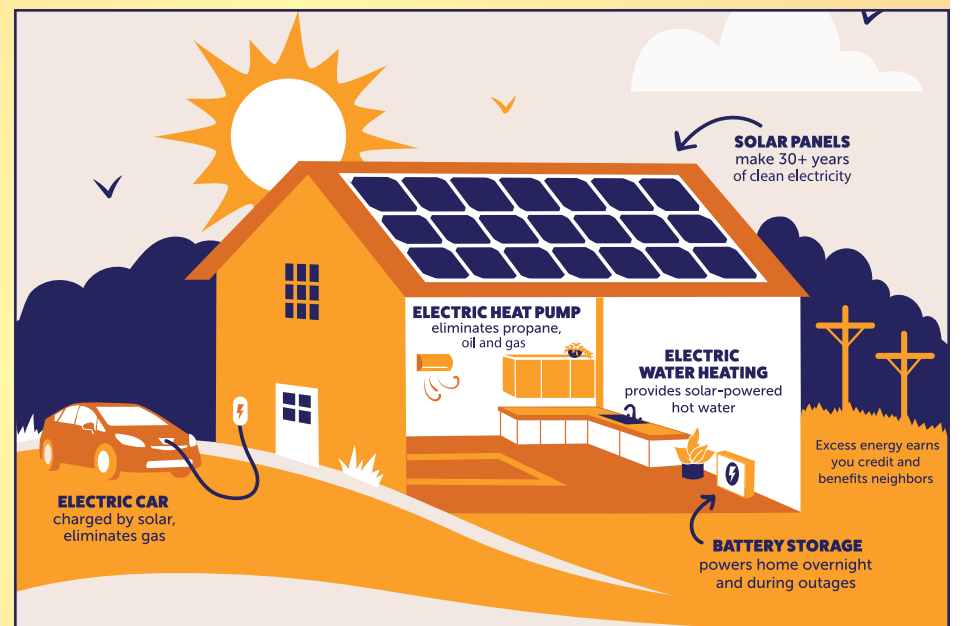
southwest corner of the state. The town and the county will see the benefit of new jobs during construction of the array, and they will see the ongoing benefits of increased revenues in the long term.

Chinook Solar will hardly be the last development of its size in New Hampshire. There are other large projects that are moving forward in development. They are not throwbacks to the old "big" arrays of 3 MW or less, either. They are big, comparable to the Chinook Solar project.

Also, it is not just solar PVs that are growing. We have early word of an improvement at the Moultonborough solar array. The site will have a large battery installed to help reduce the monthly demand peaks. An important part of the costs of the transmission system relates to the peak demand, so

reducing that demand can cut costs for everyone who pays electric bills.

All things considered it would seem that New Hampshire may be catching up with other states in the Northeast. The pragmatic people of the state are not so in love with fossil fuels and their costs that they will find it hard to switch to cleaner renewable energy, when it is as cheap as it is. ♻️



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A 2.0MW solar array consisting of 8000 panels is located on land owned by NHEC off Moultonborough Neck Road in Moultonborough, NH. Power produced by the array will enter NHEC's distribution system at nearby Moultonborough Neck Substation. Image: NHEC.

W. S. Badger Company: Practicing Sustainability

George Harvey

The September issue of Green Energy Times had an article about a solar array at W. S. Badger, a company in New Hampshire that specializes in personal care products (<https://bit.ly/2FU0kzu>). We thought it might be a good idea to go a bit further into the company and how it is run, with a particular view to sustainability.

W. S. Badger came about because Bill Whyte, a carpenter, had problems with the skin on his hands when he worked in the cold New Hampshire winter. He created a balm that worked so well he wanted to share it with everyone else. To do that, he created the company W. S. Badger in 1995.

Since that time, the Badger product line has expanded to include well over a hundred personal-care products, along with a few related offerings ranging from outdoor candles to T-shirts.

W. S. Badger has always been a family-oriented business. It is also a benefit corporation, or B-Corp, meaning that while it is allowed to be profitable, it must operate for the public good, with care for the environment, and it has to do these things transparently. The company's mission, stated at its website, www.badgerbalm.com, consists of two things.

To create fabulously pure and effective products of the highest natural quality, based on simplicity and thoughtful preparation, with the intention to protect, soothe, and heal.

To run a business that is fun, fair, and profitable; where money is fuel, not a goal; and where our vision for a healthier world finds expression through the way we work and through the way we treat each other and the people we serve.

The company also operates according to a stated set of principles. They



The 486.7kW rooftop solar array at W.S. Badger is expected to generate approximately 600,000 kWh of clean electricity per year which will cover 100% of Badger's electrical needs. Photos courtesy W.S. Badger.

speak to personal responsibility and working as a team, respect for both employees and those outside the company, charity, and healing. Working for a sustainable environment and organic agriculture are both stated goals. The principles also go to other issues, including honesty and integrity. One in particular stands out to me, because I cannot think of seeing it before as a business principle: "Fun is good."

The quality of a personal-care product is heavily dependent on the quality of its ingredients. W. S. Badger has taken the approach that its products should be certified organic where applicable, natural, biodegradable, and gluten-free. In some cases, other criteria apply, such as a guarantee of the particle sizes of zinc oxide in sun screens.

There are also other important issues, and W. S. Badger has put attention onto these. Products are certified to be cruelty-free and to use fair trade certified ingredients.

In those regards, it is interesting to see that Badger is very open about where it buys source materials. The company does not buy in a market where anything answering a generic description of a prod-

uct will do. The rose essence all comes from one farm in Bulgaria. The olive oil all comes from one source in Spain, where it is milled within three hours of the time the olives are picked.

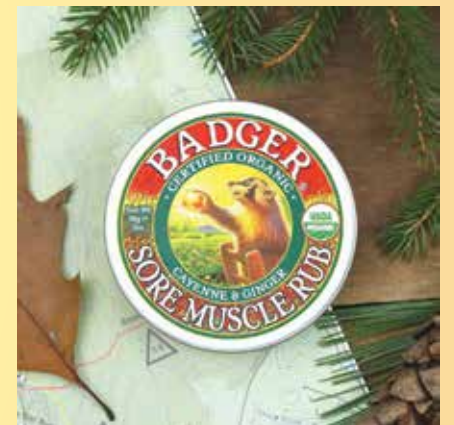
As if that is not enough to set W. S. Badger apart, there is more, and it is locally important. Badger's employee benefits are not just good. They are extraordinary. We all have heard the saying, "There's no such thing as a free lunch." Not only does that saying

turn out to be untrue, when employees eat the free lunch, they are paid to do it. That is just one of a long list of benefits. Important others are more-than-generous maternity, baby, and child care assistance. Life insurance is included, also. But the grand-scale benefits are complemented by some that show careful consideration to smaller needs, such as free long-distance calls of up to ten minutes.

It should not be surprising to anyone that W. S. Badger has won awards for corporate practices. Year after year, the company has won the Certified B Corporation Best for the World: Overall and Best for the World: Environment awards. And in case you go to the Badger website to find the list, I should mention that they haven't had time to add those awards in 2019 yet. But they did win them. The other awards and honors make an impressive list.

We would remind everyone that W. S. Badger's products are all now made with electricity from the company's own solar array. And you can read about it at <https://bit.ly/2FU0kzu>.

W. S. Badger's website is badgerbalm.com. ♻️



Environmental-friendly products offered by W.S. Badger. Photos courtesy W. S. Badger.

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- Residential Renewable Energy Tax Credit: <http://bit.ly/energy-gov-R-E-tax-credit>
- 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

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- Details at www.rerc-vt.org or call (877) 888-7372.

• **More into 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 border Rutland Co.) contact Melanie Paskevich mpaskevich@nwwvt.org at NeighborWorks of Western Vermont, (802) 797-8610.

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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. 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, con-

tact your utility for more information.

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- 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 \$4,000.
- DIY: \$100 back for completing eligible projects, like weatherizing windows and doors, and sealing air leaks in your attic and basement.

Appliances (must be ENERGY STAR)

- Dehumidifiers: \$25 - \$40 rebate
- 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: \$500 discount at participating retailers, plus \$100 for proper removal/disposal of old stove
- Heat Pumps:
 - Air-to-Water System: \$1,000/ton rebate
 - Centrally-Ducted System: \$800/ton rebate
 - Ductless Heating & Cooling System: \$200-\$300 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: \$200 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

- Pool Pumps - up to \$600 back on select ENERGY STAR models
- 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.

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 kWh/yr for new solar thermal facilities fifteen collectors in size or fewer; \$0.07/rated or modeled kWh/yr for new solar thermal facilities greater than fifteen collectors in size;
 - Expansions to existing solar systems not eligible.

Contact ClSolarRebate@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.

PACE

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. Please refer to the Residential PV program.

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.

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 50 gallon or greater

Loan Buy down - NHEC provides interest subsidies 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.nhrebates.
- 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.

MASSACHUSETTS

Commonwealth Solar Hot Water (SHW) Programs

- Visit <http://www.masscec.com/shw>

MassSave Heat Loan SHW

Through this loan program, customers may borrow at 0% interest the costs of a Solar Domestic Hot Water and/or Thermal Heating system. Apply through receiving the Mass-Save Energy Audit. .

Energy Efficiency

- Visit www.masssave.com/residential-program. Please call 866-527-7283 to schedule a free home energy assessment.

Mass. Solar loan Program

Mass Solar Loan focuses on connecting homeowners who install solar PV systems with low-interest loans to help finance the projects.

- The \$30 million partnership program between Massachusetts Department of Energy Resources (DOER) and MassCEC, will work with local banks and credit unions to provide

financing to homeowners interested in solar electricity. DOER's program expands borrowing options through lower interest rate loans and encourage loans for homeowners with lower income or lower credit scores.

- Mass Solar Loan: www.masssolarloan.com. The most updated loan principal buy down rate based on household income can be found For Residential Members at <http://www.masssolarloan.com/>.

- Renewable Thermal Infrastructure Grant Program: www.mass.gov/funding

MA SMART INCENTIVE

This info may have been updated. Check website. SMART incentives are only available for PV systems sized under 25kW. All Ever-source West and Most of National Grid Blocks are full for 25kW and larger. There will be a 400MW review process this spring and summer. Details at <http://masmartsolar.com> and <https://www.mass.gov/solar-massachusetts-renewabletarget-smart>.

MA STATE INCENTIVE

This info may have been updated. Ck website. MA State Incentives can be found at: www.masscec.com/get-clean-energy

- Incentive updates for air-sourced heat pumps: <https://www.masscec.com/air-source-heat-pumps>
- Wood stove Change-out program: <https://www.masscec.com/commonwealth-wood-stove-change-out>.

HEATING PROGRAMS

This info may have been updated. Ck website.

- The Commonwealth Woodstove Change-Out program, a partnership between MassCEC, the Massachusetts Department of Environmental Protection and the Department of Energy Resources offers rebates to assist Massachusetts residents in replacing non-EPA-certified wood stoves with cleaner, more efficient EPA-certified wood or pellet stoves. Woodstove Program Info: <http://bit.ly/mass-cec-woodstoves>
- Heat Loan info: <http://bit.ly/mass-save-heat-loan>
- Insulation Incentives: <http://bit.ly/mass-saves-home-insulation>

ELECTRIC VEHICLES

This info may have been updated. Ck website: <https://mor-ev.org/>

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.nyserdanyc.org/ny/PutEnergyToWork/Energy-Program-and-Incentives/>

EV Incentive from National Grid

National Grid, in partnership with BMW, is bringing eligible customers an incentive on a BMW i3 or BMW i3s EV. Form is at <https://www.NG-BMWi3>.

- Energy Rebates: <https://NG-energy-rebates>

Heat Pumps

\$1000 per ton NYSERDA incentive. NYSEG/RG&E rebate program up to \$1050. More info at <http://bit.ly/NYSEG-Rebates>.

Home Energy Waste

Getting a home energy assessment can help you take control of your energy costs, identify where your house is using the most energy and which improvements would have the biggest impact on your bottom line. Heating and cooling costs frequently account for 50% of residential energy bills. Identifying your energy waste can lead to big savings. Visit: <http://bit.ly/ny-nrg-waste>.

RENEWABLE ENERGY/NY-SUN

<http://ny-sun.ny.gov/>

NY-Sun is structured around customized Megawatt (MW) Blocks targeted to specific regions of the state. To learn more, see the Megawatt Block Incentive Structure.

The Megawatt (MW) Block Dashboard

provides real time info on the status of block and current incentive levels by sector and region. Block status is updated as applications are submitted, so check for current status. <http://bit.ly/MW-block>

Residential and Small Business

- <http://bit.ly/ny-sun-Solar-Res-sm-bus>

Commercial and Industrial

- <http://ny-sun.ny.gov/Get-Solar/Commercial-and-Industrial>

Commercial Energy Storage

NYSERDA is providing \$350/kWh of energy storage capacity in addition to the current NY-Sun solar incentive. <https://on.ny.gov/2FvS6L1>

Community Solar

- <http://bit.ly/NY-sun-Community>

Commercial/Industrial PV Installer

- <http://ny-sun.ny.gov/For-Local-Government/Local-Government>

Residential/Small Commercial Solar PV Installer

- <http://ny-sun.ny.gov/Get-Solar/Find-A-Solar-Electric-Installer>

Financing Options

- <http://bit.ly/NY-Sun-Financing>

Clean Power Estimator

- <http://bit.ly/NYSUN-power-estim>

Geothermal

- rebate of \$1500 per ton of installed capacity for residential/small-scale systems, \$1,200 per ton for commercial/large-scale systems up to \$5000

Electric car

- buyers in New York State can now get a rebate of up to \$2,000 on qualifying EV models from participating dealers. See <https://on.ny.gov/2Rd14zL>

- Charge Ready NY: \$4,000/installed Level 2 electric vehicle (EV) charging stations for public, workplace, and multi-unit dwelling stations. <http://bit.ly/ChargeReadyNY>.

Utility sponsored incentives & tips:

http://bit.ly/utility_sponsored_incentives

Clean Energy on Farms

- \$19 Million Available to Accelerate the Use of Clean Energy Technologies On Farms. Learn more at: <http://bit.ly/NYSERDA-Farm-Clean-Energy>.

National Grid

- National Grid savings for customers, <http://bit.ly/Thanks-For-Saving-Energy>

- For more utility rebates google the utility name and search for rebates.

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

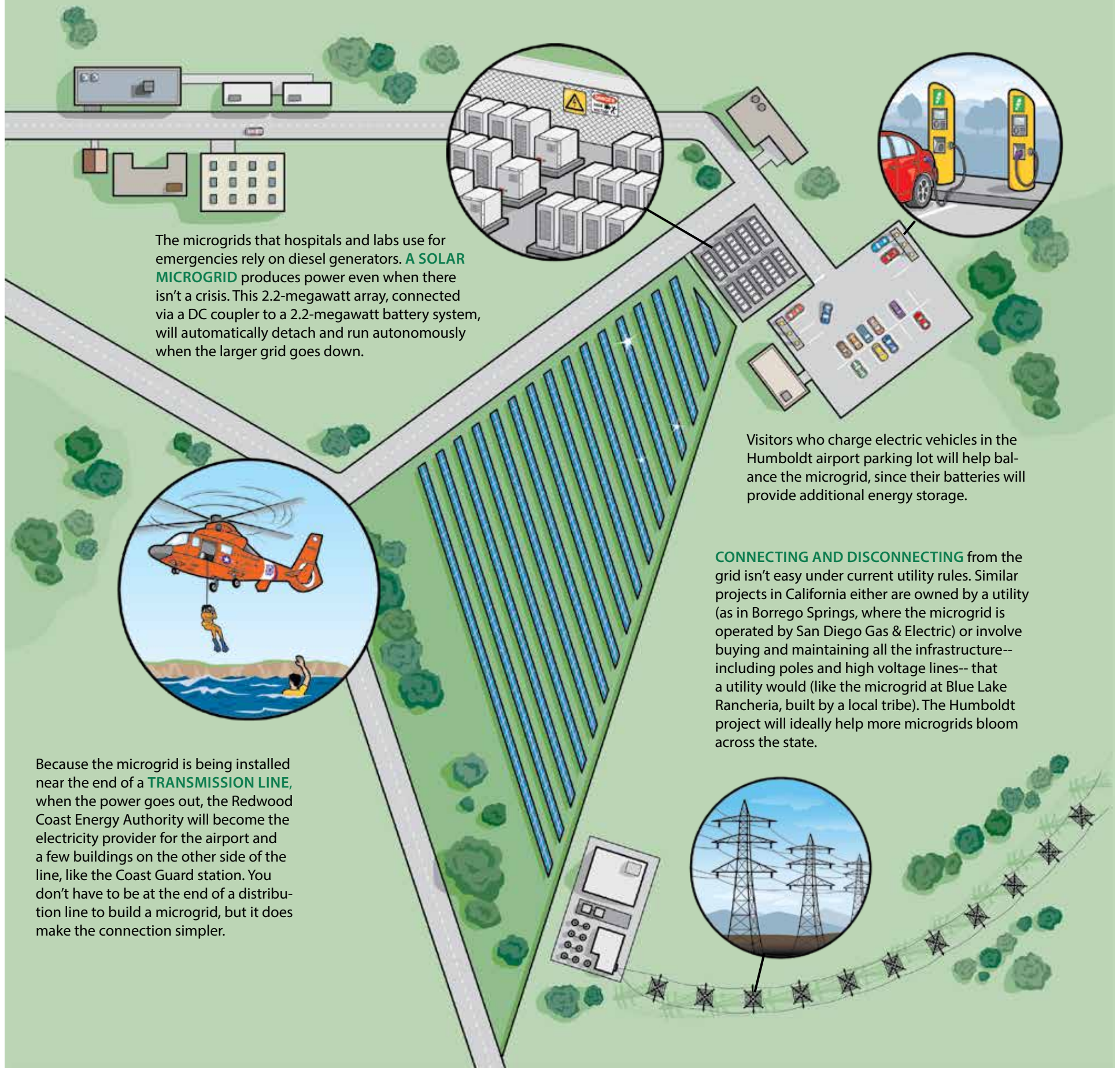
A Microgrid of One's Own

Humboldt County, California is at the end of the line, electrically speaking. Earthquakes, floods, landslides, and wildfires cut off utilities ---and roads-- into the area. PG&E, the state's largest utility, has begun preemptively cutting power when the fire risk along the path of its transmission lines is high.

So, Redwood Coast Energy Authority, a coalition of local governments working on sustainable energy projects, teamed up with Schatz Energy Research Center at Humboldt

State University to build a microgrid to keep the power on for critical operations-- and sell electricity directly to local rate-payers when all is well.

A microgrid is complicated for technological and legal reasons. When this one is completed in 2021, it will be the first of its kind and a working example of how other regions can subsidize disaster preparedness by getting into the renewable energy business. **—Heather Smith**



The microgrids that hospitals and labs use for emergencies rely on diesel generators. **A SOLAR MICROGRID** produces power even when there isn't a crisis. This 2.2-megawatt array, connected via a DC coupler to a 2.2-megawatt battery system, will automatically detach and run autonomously when the larger grid goes down.

Visitors who charge electric vehicles in the Humboldt airport parking lot will help balance the microgrid, since their batteries will provide additional energy storage.

CONNECTING AND DISCONNECTING from the grid isn't easy under current utility rules. Similar projects in California either are owned by a utility (as in Borrego Springs, where the microgrid is operated by San Diego Gas & Electric) or involve buying and maintaining all the infrastructure-- including poles and high voltage lines-- that a utility would (like the microgrid at Blue Lake Rancheria, built by a local tribe). The Humboldt project will ideally help more microgrids bloom across the state.

Because the microgrid is being installed near the end of a **TRANSMISSION LINE**, when the power goes out, the Redwood Coast Energy Authority will become the electricity provider for the airport and a few buildings on the other side of the line, like the Coast Guard station. You don't have to be at the end of a distribution line to build a microgrid, but it does make the connection simpler.

BE PREPARED FOR EMERGENCIES: GENERATORS AND BACKUP BATTERIES

Keeping your power on when things go bump in the night

Chi Woodruff

As global warming increases and sea levels rise, natural disasters are also expected to increase. Only about one fifth of U.S. and Canadian homes have invested in a backup power source. The predominant power source for when natural disasters strike is gasoline- diesel- or propane-powered generators. But what happens if you run out of fuel or do not have the means to transport a generator? Let's review the best options for backup power and emergency preparedness. We'll focus on easily transportable power sources.



A tree that fell due to the weight of ice in Troy, New York. Image: Wikipedia

As we mentioned, traditional backup power systems are gas powered generators with combustion engines. These engines create noise and emissions, so they can only be used outdoors in well-ventilated areas. The initial cost notwithstanding, another drawback to generators is that they are not the most storage-friendly devices. Besides general maintenance like oil changes, fuel must be treated with additives to ensure it does not break down during storage. Generators should be run once for a couple of hours monthly to keep everything lubricated internally and charge the battery if one is included. Some generators might not be transportation-friendly either, with larger models weighing in at well over 100 pounds or more and taking up a lot of space. Generators do have one advantage though: with access to fuel, a generator can supply large quantities of power during an outage.

Unlike a generator, lithium batteries create no exhaust fumes, so you can use them in a confined space with no ill effects. You can store them fully charged as long as you cycle them (discharge and recharge) them at least

once every six months. Lithium batteries naturally discharge at about 3% per month and require very little maintenance. Keep in mind, if you have not checked your batteries in a few months, the natural discharge rate will have lost some of their charge. For instance, RELiON lithium batteries are also light, only weighing an average of about three pounds per amp-hour. Their light weight combined with a small footprint makes them easily transportable energy-dense power sources.

Check out the table for the models we think are great options for an emergency preparation kit that can go with you.

It is important to keep in mind what disaster you are preparing for. Generators and lithium batteries both have a place in emergency preparation. Lithium batteries

can be used to power essentials and, in an ideal situation with adequate sunlight, solar panels can be used to recharge your batteries. We believe lithium batteries yield the clear advantage, but a gas-powered generator combined with lithium batteries can complement each other well in some situations. Will there be adequate sunlight to power solar panels? In some cases, a small 1,000-watt gas generator may be a necessary fallback option to recharge batteries if you're out of power for an extended period without sunlight.

We've discussed sizing battery banks and calculating power needs for recreational purposes in a previous article in Green Energy Times (see ????) and this isn't much different. Be sure to consider what items you would like to run and for how long during an emergency. Sometimes the ability to have simple comforts like a cup of hot coffee can make an extremely difficult situation bearable. The following batteries would be great for emergency kits paired with a small inverter. Note: the estimates in the table are based on average watt ratings of appliances. Actual results will vary based on your specific devices and the length of time using each. The folks at RELiON battery are always happy to help you with information on larger household backup power needs. Learn more at reliombattery.com or call 404.915.3015.



EMERGENCY PREPAREDNESS BATTERY OPTIONS / RELiON BATTERY CO.							
RELiON Part #	Amp Hours	Energy (Wh)	Length	Width	Height	Weight (lbs)	Possible Uses
RB5	5	64	5.9	2.6	3.9	2	Charge mobile phones and power a small radio for a few hours
RB10	10	128	5.9	3.9	4	3.6	
RB20	20	256	7.1	3	6.7	5.6	
RB20-LT	20	256	7.1	3	6.7	6.6	Charge mobile electronics several times, power a small radio, laptop, and a couple led lights for a day or two.
RB35	35	448	7.7	5.2	6.7	11	
RB50	50	640	7.8	6.5	6.8	15	
RB60	60	768	10.2	6.6	8.2	19.4	Charge mobile electronics, power radios, laptops, led lights, small personal space heater, and coffee maker for a day or two.
RB75	75	960	10.2	6.6	8.6	24	
RB80	80	1024	12	6.6	8.6	25	
RB100	100	1280	13	6.8	8.8	30	
RB100-LT	100	1280	13	6.8	8.8	30	

Renewable Energy Funding Opportunities

- US Forest Service Wood Innovations Funding Opportunity (<http://bit.ly/WoodInnovationsFunding>) supports proposals that significantly stimulate or expand wood energy and wood products markets that support the long-term management of National Forest System and other forest lands. Application deadline: Jan 20, 2021.
- US Forest Service Community Wood Energy and Wood Innovation Grant Program (<http://bit.ly/WoodEnergyandInnovationGrant>) issues grants to fund the "capital cost for installing a community wood energy system or building an innovative wood product facility." Application deadline: Feb 3, 2021.
- DOE, Solar Technologies Office: Connected Communities (<http://bit.ly/SolarConnectedCommunities>) funds grid-interactive efficient buildings with diverse, flexible end-use equipment and other distributed energy resources that collectively work to maximize building, community, and grid efficiency. Concept paper due Feb 17, 2021. ♻️

Chi Woodruff is a Sr. Product Manager at RELiON Battery. Chi's experience includes product management in distribution and manufacturing industries along with a history of analysis, product launches, rebranding and life-cycle management in the battery industry. In his free time, Chi is an avid runner and pacer at many races in Southern California. ♻️



When you're powering your home or business, you need energy that you can depend on around-the-clock, no matter if you're on or off the grid. RELiON Lithium Iron Phosphate (LiFePO4) batteries offer safe, clean and high power energy solutions for all types of renewable energy systems.

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USDA Awards \$2.2 Million to Local Farmers and Producers

Jessie Haas

The USDA has awarded \$2.2 million in grants to farmers and producers in Vermont and New Hampshire under the Value-Added Producers Grant program (VAPG).

Businesses receiving grants include Runamok Maple in Fairfax, VT which will use its \$248,063 grant to expand processing and diversify product packaging. Runamok sugarbush is certified organic through the Northeast Organic Farmers Association (NOFA) and Bird Friendly through the National Audubon Association. Owners Laura and Erik Sorkin make land protection a priority, and note in their blog (February 2020), "The real difference in organic vs. non-organic is the assurance that an organic producer has treated his or her woods, not as a sap factory, but as a living ecosystem." This means maintaining biodiversity, not a maple monoculture; allowing trees to reach a minimum size before tapping; maintaining woods roads so no soil runs off; and using best practices for wildlife habitat, which includes leaving dead trees standing and fallen limbs rotting on the ground.

In addition, Runamok has installed a solar array on the roof of its new plant in Fairfax. The older building, once used to manufacture Scrabble tiles, has a good roof orientation, and the array designed and installed by Norwich Solar Technologies is expected to meet all its energy needs.

Echo Farm in Hinsdale, NH received a \$250,000 grant to fund market expansion of its puddings. Echo Farm, which describes itself as an overgrown 4-H project, is the first dairy farm in the U.S. to be certified humane by Humane Farm Animal Care.

5 Generations Creamery in West Glover, VT, will increase production and distribution of its small-batch farmstead cheese with its \$250,000 grant. The family has made and sold maple products for over a hundred years.

Flag Hill Winery & Vineyard in Lee, NH will upgrade processing and develop new markets with its \$250,000 grant. Owned by distiller Brian Fergu-



In March 2019, Norwich Solar Technologies installed a 150 kW-AC solar system powering Runamok Maple's manufacturing processes in Fairfax, VT. Runamok Maple is a premium, organic maple syrup producer. Courtesy photos.

sun and his wife, Maddie, the winery sits on a 110 parcel of conserved farmland, growing grapes, apples and grain for the distillery and vegetables.

Agricola Meats in Pantown, VT, received \$204,098 to increase sales of its farm-produced, cured salami. Agricola owner Alessandra Rellini and farm agronomist Stephano Pinna were raised in Italy and state their goal as producing "a high quality product that reflects our taste and tradition." They also place an emphasis on having healthy, well-treated animals, and a holistic approach to the ecosystem. Their 60-acre farm is a partnership of 'animals' (pigs, chickens, sheep, ducks, bees, and farmers) and land. They use intensive rotational grazing and silvopasture techniques and heat their home with their own wood. The team has bred its own strain of chickens, a project that took six generations and 3.5 years, and their own pigs, a mix of several breeds. One innovation is raising ducks for Boundbrook Farm in Ferrisburgh. They love hatching ducklings, but after about two weeks the smell begins to outweigh the cuteness

factor. Luckily that's just the right time to transport the ducklings six miles up the road to the rice paddies, where the ducks live all summer weeding and fertilizing the rice. In the fall, they are brought back home (on the hay wagon), fattened and

harvested, except for the carefully selected breeding stock. Pigs are rotationally grazed, fed a mix of grains—not corn, which makes for an acidic meat—and live longer than most pigs raised for meat. Agricola also raises Icelandic sheep, which need no grain and seem to instinctively stop short of overgrazing their pasture. Agricola also sells raw honey, pasta, and meat pies, and runs a meat CSA. Their farm-cured salami is available by mail-order.

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Vermont.

Source links available on GET's website where this is also posted ♻️

NH Rural Renewables

Solar, wood and energy efficiency technical assistance for NH's rural small businesses

www.lccc.edu/nhrr

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www.LEDdynamics.com

RECOMMENDED DOCUMENTARIES

Cont'd from p.2

point stresses the importance of reintroducing more biodiversity into nature. By fishing responsibly, slowing population growth, and using renewable energy rather than fossil fuels, among other measures, Attenborough is hopeful that we can still return the Earth to what it was. Certainly, the solutions that David Attenborough proposes are simplified for the general public to understand and appreciate. But they are also effective and realistic goals for us to achieve.

Attenborough eloquently yet passionately describes the disasters that the Earth and humanity are facing, and it is an extraordinarily impactful message. People need to hear and understand his opinion in order to give humanity a chance at survival.

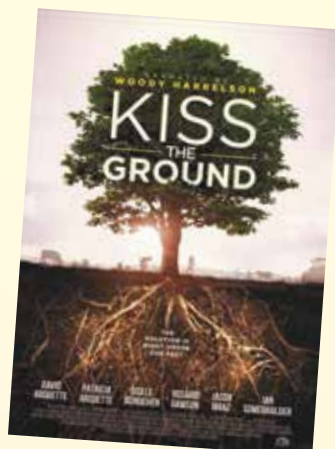
Kiss the Ground

As a member of Generation Z, like most of my generation, I have worried for years about the Earth that we will inherit. I have seen the pictures of polar

bears clinging to a tiny block of ice in an enormous, inhospitable ocean, and I've watched as wildfires rage through California, Oregon, Colorado, along with the intensity of the hurricanes, flooding and other weather disasters.

The effects of climate change are becoming more and more devastating every day, and experts have given dire warnings for the near future. We would love a be-all and end-all solution to climate change. Unfortunately, we also know that such an answer doesn't exist. However, the documentary *Kiss the Ground* provided an insightful and achievable method by which humans can address climate change.

Their proposition is as follows. In farming, by avoiding tilling and the use of chemicals, we could avoid erosion to the soil and maintain the microbes in it. In turn, the microbes will help the soil se-



quester carbon from the atmosphere. According to the experts in the documentary, if farmers began to imitate nature in their farming practices, we could not only stop global warming but begin to reverse it in just 30 years. Without these measures, humans will ultimately 'desertify' two-thirds of the entire Earth, risk driving up to a

billion people from their homes by 2050, and push global warming to a point of no return.

The question at this point is between desertification or regeneration. Will we switch to regenerative farming and put ourselves on the right path to ensure life for humans past this century or continue as we are now, which will inevitably lead to the downfall of civilization itself? For

me, the answer is clear. I'm sure that no one hopes for a sixth mass extinction.

However, at this point, our future lies with politicians, who, especially in the current United States, have yet to take many measures to avoid the catastrophic end looming within sight. As such, at this pivotal point in our planet's history, people must be informed to demand appropriate action. It is essential that we watch documentaries such as *Kiss the Ground* to understand the threats that Earth is facing, as well as realize that we have several paths to choose from. *Kiss the Ground* provides a hopeful, yet urgent commentary on resolutions to the existential threat that we all face.

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 four-year college to study engineering or biology. ♻️

Energy Audit Grants and Clean Energy Financing from NH CDFA

Scott Maslansky

Energy costs can be a significant and unpredictable expense for organizations of all kinds, particularly in New England where energy rates are high and heating seasons are long. New Hampshire businesses, nonprofit organizations, and municipalities pursuing energy efficiency, renewable energy, and clean technology projects, can offset the burden of energy costs while reducing their impact on the environment.

Whether the goal is reducing future energy and maintenance costs, improving comfort, reducing health and safety concerns, or meeting clean energy and carbon reduction objectives, clean energy investments will benefit your organization, your customers and your community. To help accomplish these goals, you may be eligible for financing and funding support from the Community Development Finance Authority (CDFA).

Energy Audit Grants for Businesses

Jennifer Briggs, owner of A Place to Grow in Brentwood, NH took advantage of CDFA's Small Business Energy Audit grant program and Clean Energy Fund financing in 2019. She noted, "The energy audit helped guide our decision-making and was the first step in understanding how to pursue energy independence. CDFA supported me throughout the process with financial resources, technical assistance, and making connections to additional USDA grant opportunities."

Weatherization, lighting upgrades and installation of heat pumps reduced energy use by 58%, and a 14kW solar installation saved the business over \$400 a month compared to the previous summertime months. Read more about this project in G.E.T.'s November 2019 issue at <http://www.greenenergytimes.org/2019/11/15/a-place-to-grow/>.

Small Business Energy Audit Fund grants cover 75% of the cost of a comprehensive energy audit. CDFA works with businesses to select an energy auditor, provide low-cost financing for implementation and identify other sources of funding including utility incentives and USDA loans and grants.

Other New Hampshire business grant recipients include: Rattle River Hostel

& Lodge (Shelburne), House By the Side of the Road (Garden Center in Wilton), Geokon, LLC (Manufacturer in Lebanon), Britton Lumber Co. (Bath), Malnati Farm (Walpole), and Road Hawg BBQ & Swine Dining (Gorham).

Funding for this program is provided by a USDA Rural Energy for America Program (REAP) grant.

New Energy Study Grants for Municipalities and Nonprofit Organizations

NH municipalities and nonprofit organizations have a new opportunity to apply for grant funding to reduce the cost of energy-related studies. In October 2020, CDFA launched the Community Facilities Energy Assessment and Technical Assistance Grant Program to cover 75% of the cost of eligible studies. The program provides expertise that will help guide organizations to important decisions about their facility improvements. Grants can support energy analysis at various stages of design.

Energy audits, energy design charrettes, solar feasibility studies, and structural analyses to support the addition of roof insulation or solar are examples of eligible studies. Funded studies will identify and support the implementation of projects that reduce future operating and maintenance costs and improve building comfort and health, allowing organizations and communities to better support their core missions.

Funding for this program is provided by a USDA Community Facilities Technical Assistance and Training grant.



Paragon Digital Marketing renovated and moved operations to this vacant historic church in Keene, using CDFA financing to add 34 kW of solar. The company also installed air-source heat pumps, LED lighting and made significant improvements in air sealing and insulation. Photo: Scott Maslansky.

Clean Energy Fund Low-Interest Loans

CDFA's financing resources support municipalities, nonprofits and businesses with flexible terms for projects ranging from heating equipment and thermal envelope upgrades to renewable energy installations. Loans of up to \$500,000 are available with the goal of creating cash-flow positive projects.

VT Solar Expands State's Pollinator Habitat

Cont'd from p.10

foot, Bee the Change will offset your footprint by planting a habitat equal to the square footage of your residential or business space. Several of Vermont's leading B-Corps have already signed on as well as over 200 other organizations and individuals.

Guidance is available from the UVM Extension office for landowners hosting solar projects. Businesses planning new solar projects are encouraged to take the pollinator pledge and complete a Pollinator Scorecard to provide transparent guidance for vegetative management plans using pollinator-friendly plants.

For more information, visit Renewable Energy Vermont at <https://www.revermont.org/resources/pollinator-solar/> or Bee the Change at <https://www.beethechangehoney.com/>.

Renewable Energy Vermont (REV) represents businesses, non-profits, utilities,

CDFA has financed large municipal solar arrays, efficiency projects for low-income housing, and a variety of commercial clean energy projects. Moving forward, the organization looks to support investments in battery storage, electric fleet vehicle charging, and new clean energy technologies.

Applications for all clean energy programs are accepted on a rolling basis.

For more information about CDFA's programs contact Scott Maslansky, Director of Clean Energy Finance (603-717-9123 / smaslansky@nhcdfa.org) or visit <https://resources.nhcdfa.org/programs/clean-energy-fund/>.

The Community Development Finance Authority (CDFA) is a state-wide nonprofit public authority focused on maximizing the value and impact of community development, economic development and clean energy initiatives throughout New Hampshire.

USDA Rural Development provides loans and grants to help expand economic opportunities and create jobs in rural areas. This assistance supports housing, infrastructure improvements, business development, high-speed broadband service, and community facilities servicing education, public safety and health care. For more information, visit www.rd.usda.gov. ♻️

and individuals committed to eliminating our reliance on fossil fuels by increasing clean renewable energy and energy efficiency. Vermont's clean energy economy supports at least 18,800 sustainable jobs, representing approximately 6% of Vermont's workforce. Together, we will achieve 100% total renewable energy (electric, thermal, transportation). Join us at www.revermont.org.

Bee the Change is a not-for-profit with fields in the Northeast US. They were the first in the nation pursuing this and there are now programs in over 20 states. Nationally they are working with the Pollinator Partnership, and locally with the Gund Institute at the University of Vermont. They are also bringing education into schools and other settings and bringing groups to fields designed to tell the story of renewable energy and pollinators. The first of these demonstration fields has been installed at Rock Point in Burlington, Vermont, and other installations are underway. Learn more at www.beethechangehoney.com. ♻️

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BATTERY-POWERED ELECTRIC CHAINSAWS CAN GET YOUR JOB DONE

Nancy Rae Mallery and Barbara Whitchurch

Battery-powered electric chainsaws entered the mainstream just a few years ago, and they are directly comparable to like-sized gas models. For this article, we spoke with folks who have experience with some of the latest, brushless models.

The Bradford, Vermont Highway Department uses only three battery-powered chainsaws, one for each of its trucks. We spoke with Phil Page, who has been the highway foreman for the Town of Bradford for the past 15 years and was on the crew for 20 years. He said he was “born with a chainsaw in his hands.” He gave multiple reasons for liking the electric chainsaws: there is no smell of gas in the truck; there is extra room without gas cans; they are quiet and powerful; and they don’t require the kind of maintenance that the gas models do. [Ed.: May we add: no problem starting in the cold; no idling; can’t “flood”; no tuning or plug replacement; saw only runs when actually cutting.] System foreman, Grant Poliquin, enthusiastically said, “I love them. They make the job go faster.” Tyler Gillis, a crew member, chimed in, “They work really well!”

Bradford Highway Department uses the Milwaukee brand, because they already had many of their other tools, so the batteries would be interchangeable. The Milwaukee M18 18-volt 18-inch bar saws were purchased at the Tool Barn (RentToolBarn.com), on Lower Plain Road in Bradford. The owner, Dan Perry, said a lot of contractors use the Milwaukee line of tools, and he decided to carry the saws because he found them quite interesting. (They do not rent chainsaws.) It is enlightening that nearby towns such as Corinth are also using battery chainsaws as a better option for their highway department. Fire and police departments are also using them.



Tyler Gillis (left) and Grant Poliquin of the Bradford, VT Highway Department with one of their three Milwaukee battery-powered chainsaws, which have replaced all of their gas-powered saws. SheBear, the author's Newfoundland dog, approves. All of the town trucks sport a “Clean Idle” certification. Photo: N. R. Mallery.

Greg Whitchurch: We’ve been heating our home exclusively with wood for 45 years, using large Jonsered and small Poulin and Echo chainsaws, and a bulldozer with a winch. In the winter we also heat our water with wood and cook on a wood cookstove. This spring we moved up to the Greenworks 40-volt 10-inch commercial arborist saw, the 80-volt series chainsaw, the multi-head weed whacker and tiller, and the self-propelled lawnmower.

We have 2.5 and 5 Ah batteries, and



Greg and Geoff Whitchurch up high dissecting the tree with two Greenworks saws. Inset: Geoff Whitchurch loading up the saws. Photos: Barbara Whitchurch.

the wearable harness for the big battery to further lower the weight of the (already lightweight) tools. The harness places the battery on one’s back at waist height with a five-foot cord that plugs into the machine. I still have my big Jonsered saw with 16- to 36-inch bars but haven’t used it in months.

I especially like the quietness and light weight of these tools. Plus, I don’t have to pull-start in the cold, let it idle between cuts, mix the fuel, remember to find a safe place for my cigar when refueling, or worry about the pollution.

Professionals usually invest in a “battery line.” That is, since the batteries are expensive, if one already has Makita, DeWalt, or whatever-brand power tools, and those same voltage batteries fit their chainsaws, then they’ll probably continue with that line. [Ed.: Greenworks (GW) tools are also rebranded for other major names; so, you might be using a GW tool already.]

Geoff Whitchurch (son of Barb and Greg): Over the past 35 years, I have been using gas-powered chainsaws for logging firewood for home heating. I’m 47 and started using chainsaws as a kid and continue to use them today. This past summer, my father, my son, and I had to remove a massive silver maple from my yard. (The largest branch of this tree was 25 inches in diameter, and the smallest branch was not

Right: Greg Whitchurch with the big battery pack on his back and the arborist and large chainsaws. Photo: Barbara Whitchurch.



much smaller.) I was prepared to use my four gas-powered saws, of differing sizes, for taking the tree down.

My father arrived wielding his new Greenworks 80-volt and 40-volt battery-powered saws. I figured we would use those saws to limb the small stuff, while using my gas saws to do the work’s brunt. I was WRONG!

The tree sat in a small yard, and its branches spanned at least 50 feet across my house, carriage house, and over two neighbors’ houses. Since it reached far above the two-story houses, we used an 85-foot boom lift and removed it in small-ish pieces.

The GW saws worked great, and we ended up using them for 95% of the tree removal. The 5 Ah battery lasted around an hour of on-and-off cutting. We would swap for the 2 Ah battery while the larger battery recharged. The charging time for the larger battery coincided nicely with the time it took to drain the smaller battery.

Advantages of the GW saws include: extraordinary noise reduction (chainsaw noise can cause user fatigue quickly, but I didn’t feel the need to wear hearing protectors); not breathing two-cycle engine exhaust; the saw doesn’t run when not triggering the throttle; the small-kerf bar and chain glide through the wood; and it’s environmentally clean. I now have my own GW 18-inch 80-volt saw, string trimmer, and lawnmower!

Nancy Rae Mallery, publisher and owner of *Green Energy Times*: I tried both

the Greenworks 40-volt 14-inch and the 80-volt 16-inch. Initially, I thought the 40-volt sounded tinny and toylike compared to the 80-volt, but I used it to cut up a downed pine, about nine inches in diameter and 24 feet long, with lots of branches. The lighter weight makes it easy to reach out farther. The saw ran for long enough to nearly cut up the full log. It did a great job.

I previously used the 80-volt 16-inch saw to cut up a roughly 12-inch diameter, 27-foot ash tree with big branches. I was able to cut the majority of the log with one 2.5 Ah battery charge, cutting continuously -- and it didn’t miss a beat!

I wouldn’t hesitate to use the 80-volt 16-inch or an 18-inch chainsaw on even larger trees or a big stack of firewood. The battery would run low sooner, but not its performance. If cost is an issue, the 40-V 14- or 16-inch models are great choices.

For me, the bottom line is this: battery-powered chainsaws have evolved into an awesome alternative to using fossil fuels. These chainsaws get the job done!

Nancy Rae Mallery is the owner and publisher of Green Energy Times. Barbara Whitchurch writes for G.E.T. and owns a Passive House in Middlesex, VT. ♻️

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BIO-FRIENDLY CHAINSAW BAR OIL

G.E.T. staff

Petroleum-based chainsaw bar oil is downright nasty. Living things are really not adapted to deal with petrochemicals. They cause cancer and other diseases in human beings, but they are probably bad for all living things. And chainsaws throw bar oil around all over.

Fortunately, there are natural products available that are not poisonous, work well, and cost less than petroleum-based bar oil. Many hardware stores carry non-toxic, natural bar oil. In fact, some chainsaw manufacturers produce them for their own saws. Stihl, for example, sells its own brand, Stihl Bio-Plus.

The internet has quite a lot of information on natural bar oil. A federal government site with some information worth reading can be visited at <http://bit.ly/natural-bar-oil>. While the article was posted over twenty years ago, its value seems current. It says vegetable oil can work for bar oil, but canola oil is better.

Another useful site is <https://bit.ly/best-bio-degradable-bar-chain-oil>. We recommend that those interested visit these websites. ♻️

Burning Wood to Save the Forest

George Harvey

Generally speaking, I favor letting nature govern itself. There are times, however, when this simple approach really needs to be examined and modified. With increasingly extreme weather and the invasive species driven by climate change, there are times when human intervention may be necessary.

One such time is when fallen wood lies on the land. In one way or another, wood will become other substances when it is left to nature, and the question of which substances it becomes is especially important.

There are several ways wood decomposes in nature. Among the most important decomposing agents are fungi and insects. Another important way for wood to decompose is by burning, whether in natural fires or man-made ones. Each of these produces different results.

When fungi decompose wood, it is digested aerobically. Most of the carbon given off is carbon dioxide (CO₂), a greenhouse gas that causes global warming. In an entirely natural system,



Once it is rotting, wood will not make good firewood. Decomposition driven by mushrooms might produce as much CO₂ as a fire would. Photo: Nipunm, CC-BY-SA 4.0, Wikimedia Commons, <https://bit.ly/3n2FIKK>.

powerful greenhouse gas than CO₂. Sometimes CH₄ is said to be over 80 times more powerful when considered over a short term such as 20 years. But over the long term, such as 100 years, CH₄ is said to be 20 times as powerful because it decomposes on its own in the atmosphere.

When wood burns naturally, the result can be a terrible mess. CO₂ may be the most important product of combustion, but there are lots of other products, including all sorts

of particles that rise in the smoke, only to settle down at some distance as ground-level pollution.

The wildfires in the West this year have been horrible. The destruction of plants and animals has been extremely sad. And many people have seen their homes

burn or their jobs lost. More have had to evacuate and live away from home, which is all the worse because of the Covid-19 pandemic. And even where the fires are hundreds of miles away, their pollution makes people sick. To some extent, forest falls contributed to this problem.

When we intentionally burn wood, the results can be very different. Years ago, an exceptionally fine scientist told me something that didn't make sense at the time. He said, "You should have a Franklin stove. They make the air cleaner." Decades later, I realized he said this because it is possible to burn wood while producing almost no emissions beyond CO₂. At the time, Franklin stoves and kitchen ranges were good bets for that.

Now, there are a lot of ways to burn wood cleanly in the home or commercially. Modern stoves and furnaces engineered for clean burning can be even cleaner, coming close to having only CO₂ and water as products of combustion that are released. In terms of emissions, they are much better than the cleanest stoves that existed when I was young.

One of the best things we can do with forests is to keep them clean by removing dying and dead trees and using them in well-engineered equipment. That way we can avoid methane emissions that insects give off, and we can reduce the probability of wildfires. But if you are going to harvest wood, remember to be safe. And use an electric chain saw with natural bar oil. ♻️

SNOWSPORT SUPPLIERS ASPIRE TO BEAT CLIMATE CHANGE

Roger Lohr

ClimateUnited is a snow sports industry roadmap that provides every winter outdoor company with the guidance to make a collective statement, reduce carbon emissions and be a voice for strong climate policy. The ClimateUnited roadmap was developed within Snowsports Industries America (SIA). The national trade association for the winter outdoor industry has about 600 company members including a cross section of entities such as product suppliers, representatives, retailers, ski areas and other associations. The ClimateUnited effort is under the auspices of SIA Director of Advocacy Chris Steinkamp.

The outdoor industry is valued at a combined \$887 billion, and has been coming together to face climate change. Steinkamp commented, "The questions are: How can you get your employees to embrace this? How can you change your mission? How can you start creating more sustainable products? It's more of a holistic view of climate action than a lot of the other programs that are out there."

The four pillars of ClimateUnited guide companies in key areas such as emission reductions both in operations and supply chains, integrating climate concerns into business strategy, vision, mission, investments R & D, and influencing policy with governments on all levels. Since its inception, there are about 20 brands that supported ClimateUnited including for example, Burton Snowboards, Rossignol, K2, 686, Hestra, Seirus, Jackson Hole, and Ski Utah. The companies are asked to sign the Winter Outdoor Industry Climate Pact which is a step toward tangible goals that in-



corporate actions such as the pillars outlined above.

According to Steinkamp, the ClimateUnited program could be viewed as a first step on the journey to net zero by "providing SIA members with guidance for climate action." The outdoor industry has already come together to lobby on federal policy related to climate change under the Outdoor Business Climate Partnership which includes the Outdoor Industry Association, the National Ski Areas Association and SIA. The ClimateUnited effort will provide a platform which is under development to share educational resources that would help companies create benchmarks, access specialists for expertise and opportunities, provide open source sharing for best practices and strengthen existing efforts, collaboration, and advocacy. This platform will include content webinars and experts sharing information on topics such as efficient operating systems, renewable energy, responsible resource and waste management, and effective interactions



Burton Senior Sustainability Manager, Jenn Swain, amidst the solar array at Burton headquarters. Photo: Jesse Dawson.

with increased alignment in the industry through ClimateUnited."

The snow sports business is a \$76 billion industry which is dependent on consistent winter seasons which have already become shorter and more volatile. The northern hemisphere has already lost more than one million square miles of spring snowpack, and, according to various emissions scenarios, the length of the winter recreation season is projected to be reduced 50% by 2050 for some alpine ski locations. The industry is trying to address the issues, but

it realizes that the rest of the planet will need to help.

with elected officials, all of which can have an impact on climate. Jenn Swain, Director of Global Sustainability at Burton Snowboards in Burlington, VT stated, "Climate change is a threat to the sport we love, and Burton is proud to continue its longstanding efforts in climate action and climate policy advocacy

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. ♻️



XCSkiResorts.com

A Survey of the Cleanest Home Heating Options

Jeff Rubin

The problem of climate change is so large and complex that it's easy to become overwhelmed. The past decade has seen great strides in reducing greenhouse gas emissions from electric generation and transportation, but heating doesn't get much attention, even though buildings emit nearly a third of U.S. carbon dioxide.

In many parts of America, heating is our biggest opportunity to take control of our carbon footprint. The opportunity for carbon savings is greater in colder climates, but even as far south as Virginia, heat and hot water account for more home energy use than all household lighting, electronics, refrigerator, laundry, and air conditioning combined. [see image 1]

Let's look at an example of a typical 2,000-2,500 square foot home, built between 1900 and today. It has a central heating oil or gas boiler (which distributes hot water) or furnace (which distributes hot air). Our example starts out on the dirtiest side of the clean heating continuum. [see image 2]

Our cleanest and most affordable heating retrofit option will depend on:

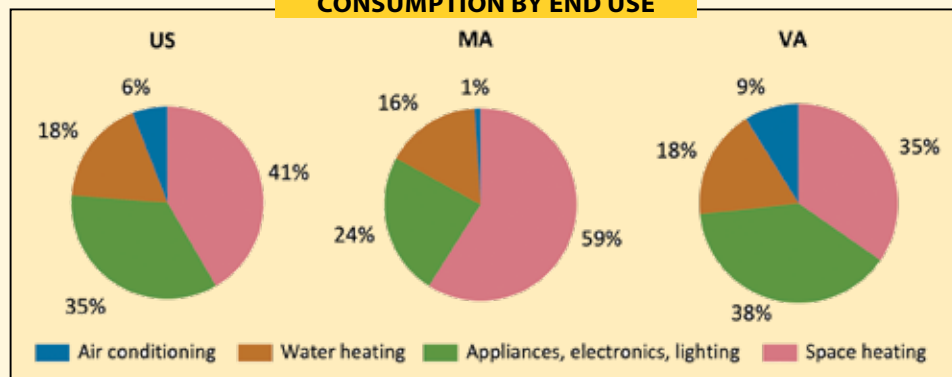
1. The comparison of our limited heating fuel options in any particular region;
2. The practicality and affordability of cleaner heating appliances; and
3. The heat-loss profile of the building we're heating.

Let's tackle heat loss first so that we size our heating appliances to be as small as possible in order to lower our heating appliance installation costs and minimize fuel costs over the 20- or 30-year life of the system.

Heat Loss Explained

The two variables of heat loss are geographic location and building performance. Your geographic location determines your design day, the theoretical coldest day of the year. Your design day is fixed, but your building's performance is variable. Building performance is a measure of the rate of air leakage through the building's exterior walls, roof, doors, windows, and other openings. Most of America's twentieth century housing stock was designed to require pumping a lot of heat into leaky buildings, because fuel was cheap and pollution wasn't something people were worried about.

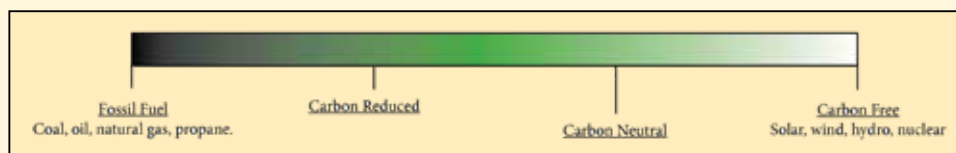
CONSUMPTION BY END USE



[image 1] Since the weather in Massachusetts and New England is cooler than other areas of the United States, space heating makes up a greater portion of energy use in homes (59%) compared to the U.S. average, and air conditioning makes up only 1% of energy use.

Weatherize First

We can save money and reduce our carbon footprint by creating a continuous thermal boundary around the building with air sealing and insulation. Whether we're weatherizing an existing structure or a new building, we seek to establish a high-performance thermal envelope before we consider adding heat with a heating appliance. The EPA provides resources to connect with state efficiency utilities and other energy efficiency program sponsors.



[image 2] Greenhouse Gas (GHG) Continuum

Now that we've taken the first step by reducing heat loss with weatherization, let's explore our climate-smart options for adding heat.

Clean Heat Option 1. Heat Pumps

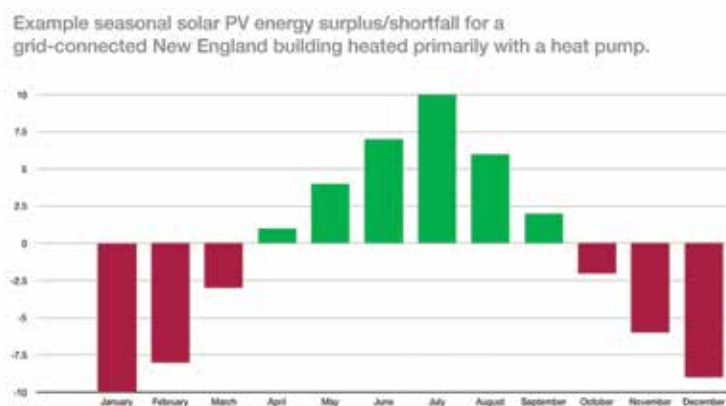
Heat pumps are electric appliances that achieve their efficiency by leveraging a thermodynamic cycle that works on one of three technologies: air-to-air (air source), geothermal (ground source), or new air-to-water. Each can be paired with either a ducted whole house delivery system or ductless mini-split room heaters.

Can a heat pump completely replace my oil or gas central heating system? [see image 4]

Generally speaking, heat pumps provide energy-efficient, affordable heating in the winter down to temperatures around 10-30°F. The performance of your particular heat pump will depend on the heating capacity of the system and your building's heat loss profile.

The point at which a heat pump can

[image 3]



©2020, Sustainable Heating Outreach & Education, Inc.

no longer keep up with the building's heat loss will vary by location. Our newly weatherized high-performance thermal envelope should allow us to completely replace our oil or gas heating with a heat pump in Energy Star zones 2, 3, and 4. In zones 5, 6, and 7, we will likely need some auxiliary heat for

the winter's coldest days.

Even if you can't completely replace oil or gas heating, a heat pump can still save money and lower greenhouse gas emissions?

Heat pumps are a good choice for reducing reliance on the home's oil or gas central heating system during the shoulder heating seasons (the fall and spring days before and after the really cold winter months). When the temperatures drop below the point where a heat pump can keep up with the heat loss, the home's central heating system can take over. How and when we switch from the heat pump back to the oil or gas system should take place before temperatures drop to a

level where the energy and cost savings performance of the heat pump is defeated.

Is a heat pump cleaner than an oil or gas central heating system?

Maybe you've heard that natural gas is a clean bridge fuel. In reality, natural gas is as bad as coal when it comes to total greenhouse gas emissions. By switching to a heat pump, the system runs on electricity so your exact answer will depend on the fuel sources of the electricity powering the heat pump. If your local utility generates electricity mostly from coal, your heat pump (and your Tesla) is essentially running on coal. Electric utilities are required to publish an environmental disclosure statement detailing the fuel sources they use to generate electricity.

How about heat pumps paired with photovoltaic solar panels? [see image 3]

Grid-connected PV solar arrays are designed to push more electricity out to the grid during the summer than the home consumes. During the winter in the northern hemisphere, the sun is too low to keep up with the household electric consumption. This means that electric consumption is cost neutral for the homeowner on an annual basis. We can also say that at worst the home's electricity use is carbon neutral. The fuel mix composition of the electricity

delivered to the home in winter will determine how close we can come to our goal of getting to totally carbon-free heating.

Clean Heat Option 2. Partially reduce fossil fuel heating by adding a pellet or wood stove

The newest EPA-approved wood stoves and wood pellet stoves are a great way to offset CO2 from the home's central heating system, when they are installed in the room where the appliance is located. This type of retrofit is particularly well-suited if our example home is one with an open floor plan or great room.

Retrofitting a wood stove requires a hearth and clearances to all combustible surfaces as required by the manufacturer. It also requires venting into a masonry or Metalbestos chimney and adequate, convenient firewood storage.

Pellet stoves also require a hearth and adequate clearances, but a pellet stove's exhaust can be direct-vented vertically or horizontally and has the advantage of longer run times without refueling. Pellet stoves utilize augers and other moving parts that can create noise that is bothersome to some people. Many retailers such as hearth and farm stores offer delivery of bagged pellets. When planning a pellet stove retrofit, consider pellet storage. Bulk wood pellet storage and delivery may also be an option, depending on your location and nature of your home site. Look for bulk storage solutions that allow you to fill a five-gallon bucket

Cont'd on p.23



Sustainable Heat for Schools & Housing



Bellows Falls Middle School



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Cont'd from p.22

for ease of carrying the fuel.

Both wood and pellet stoves require ash clean out and regular chimney cleaning, and a pellet stove should have annual maintenance service.

Clean Heat Option 3. Completely eliminate fossil fuel heating with a pellet boiler or furnace

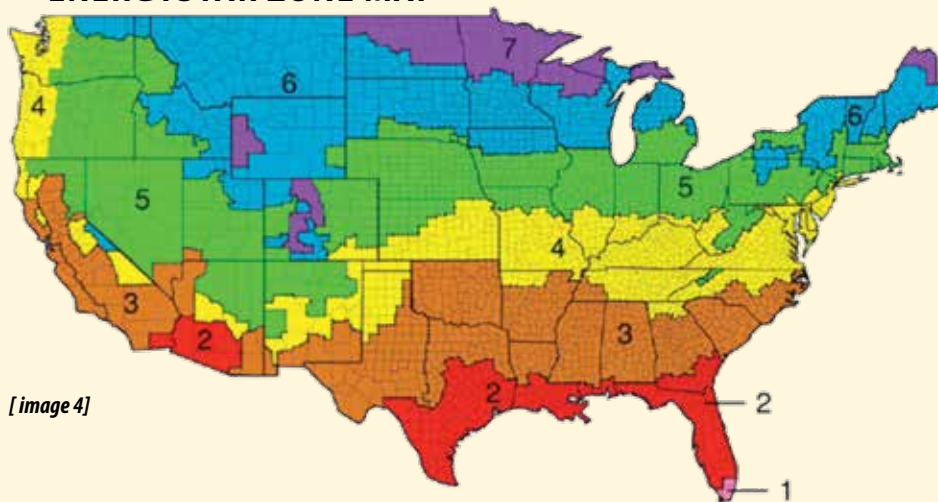
In zones 5, 6, or 7 the only renewable fuel that can achieve the high temperatures needed to keep up with the heat loss from our example home is wood, but until recently, wood couldn't compete with the automated convenience of oil and gas. Today, renewable wood pellet heating fuel has matured from stoves and the forty-pound bags usually used, to boilers, furnaces, and hands-free automated delivery with bulk trucks that handle the fuel pneumatically.

Upgrading from an oil or gas boiler or furnace to one that runs on clean, renewable wood pellets avoids the cost and disruption of changing the heat distribution system around the house. All the radiant floors, baseboard heaters, or ductwork can remain exactly the same.

It's more difficult to combust a solid fuel than a liquid or gas fuel. That makes pellet boilers and furnaces more expensive than their liquid- and gas-fossil fuel counterparts. Fortunately, many states have incentives to help make pellet boilers and furnaces more affordable. Low-interest green energy loans are also widely available.

What about the climate, forest, and health effects of wood heat?

ENERGYSTAR ZONE MAP



[image 4]

All of Alaska in Zone 7 except for the following boroughs in Zone 8:

- Bethel
- Dellingham
- Fairbanks N.Star
- Nome
- North Slope
- Northwest Arctic
- Southeast Fairbanks
- Wade Hampton
- Yukon-Koyukuk

Zone 1 includes:

- Hawaii
- Guam
- Puerto Rico
- Virgin Islands

HVAC (Heating Ventilation and Air Conditioning) climate zones. Source: Energy Star.

This issue is too important to settle for by following easy assumptions. One answer can be found in the article "Why Wood Heat is Essential to Carbon Sequestration" (<https://www.sustainableheating.org/carbon-sequestration/>):

- Heat from renewable wood pellets reduces greenhouse gas emissions by 54% compared to oil and 59% to natural gas.

- The EPA requires a wood pellet boiler to meet a higher standard for particulate emissions than oil or gas heating appliances.

- Preservation alone doesn't work. We are currently losing over one hundred acres of forest a day to development; that's the real threat.

- We need a mix of preservation and conservation of working forests. More than 60% of U.S. forest are privately held.

- 20% of forest harvest is sequestered for generations in our buildings, furniture, and other wood products.

- That leaves tons and tons of waste wood. It's those markets for waste wood that drive sustainable forest operations.

Since a dead tree is going to give up its carbon anyway, what's the best use for all that waste wood? If our example home has a heat loss profile that demands a combustion fuel other than electricity, our only options are oil, gas, or wood.

The bottom line for our example home is that the cleanest heating option will depend on the geographic location, the building's existing heating system, available resources that might be invested in energy improvements, and a survey of which fuels are locally available, including an understanding of the fuel mix of the electric utility.

Jeff Rubin is Executive Director at Sustainable Heating Outreach & Education, a nonprofit 501(c)(3) sustainableheating.org. ✂

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HISTORIC PIRELLI BUILDING PASSIVE HOUSE RETROFIT

Kate Doherty and Dylan Martello

One of the most important drivers in achieving Passive House certification is getting the project team involved from the start. Becker + Becker, the owner, architect and developer for the creative retrofit of the Pirelli Building, hired Steven Winter Associates, Inc. (SWA) Passive House, Leadership in Energy and Environmental Design (LEED), and Enclosures teams to coordinate the early design. Becker +Becker is invested in rebuilding for resilience, sustainability, and occupant health and comfort and appreciates the necessity of getting goals defined at the outset.

The Pirelli Tire Building, designed by noted Modernist architect Marcel Breuer in 1967, is located adjacent to Interstate 95 in New Haven, CT. Armstrong Rubber Co. originally owned this unique, panel-clad lab and office space from 1970-1988. The building was purchased by the Pirelli Tire Company which then sold the building to IKEA in 2003, although it was left vacant under both ownerships. The building was



The Pirelli Tire Building also known as the Armstrong Rubber Building is located in New Haven, Connecticut. It was designed by modernist architect Marcel Breuer. Image: Kenneth C. Zirkel, Wikipedia. CC-BY-SA 4.0 International (<https://bit.ly/38OKcvg>)

added to the Connecticut State Register of Historic Places in 2000. Becker + Becker is transforming the office building into a hotel and conference meeting space. Following EnerPHit guidelines and certification, the project plans to run all electric and earn NetZero, LEED Platinum, and ENERGY STAR® certifications.

In order to fulfill project goals, the planned photovoltaic system, located on the roof and carport canopies, is expected to produce 510,000 kWh/year. The building's onsite energy usage cannot exceed the onsite energy production by the PV system in order to reach the goal of net-zero.

One of the biggest challenges in planning for full electrification is the equipment and operation of the commercial kitchen. For the Pirelli renovation project, in addition to electrification of domestic hot water (DHW) and developing a Passive House-level enclosure, limiting kitchen energy use has become a key consideration during the design process.

The typical commercial kitchen, it is likely to have large exhaust hoods, multiple flat-topped grills, and deep-fryers. The typical commercial kitchen is inher-

ently inefficient with large electrical loads and high exhaust levels. In the design for the Pirelli project, the team decided to take a step back. Instead of "How can we build a standard commercial kitchen and still reach our goals?" the questions were more along the lines of "What improvements to the menu and appliance-use schedule will make this kitchen more efficient?" By asking this question, the team has been able to design with greater efficiency, maintaining staple restaurant menu items (French fries!), yet still working towards reaching net-zero and Passive House goals.

The Pirelli Building project is also taking a lead in electrification through the DHW system. In a typical hotel or multifamily building, gas-fired boilers are usually responsible for the large-scale hot water distribution. In this case, an electric heat pump system is specified and will, hopefully, set the stage for future hotel and multifamily projects in the area.

A unique aspect of this project is its status as a Modernist historic landmark. The building presents both challenges and benefits to consider, as we take on the task of reducing the carbon footprint of existing buildings, particularly hotels,

which can be notorious emitters. For the enclosure design, it was essential to keep the exterior façade and the building's appearance intact. Therefore, the insulation, air and vapor barriers for the Passive House-level enclosure will be installed exclusively on the interior of the building. A continuous plane of closed-cell insulation on the interior face

Cont'd on p.27



Concrete panel façade with existing windows prior to retrofitted construction. Courtesy photo.

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Passive House at Maple Corner: Part 3

Barbara and Greg Whitchurch

In the previous issue of *G.E.T.*, we wrote two articles about the Dawkins Passive House in Maple Corner, Vermont (bit.do/get-mcph1 and bit.do/get-mcph2). Here in Part 3, we explore some of the issues that Meg and John Dawkins considered as they focused on their personal environmental impact, and on how and where they live.

Their house is the first of six in a private residential development of 28.75 acres with shared infrastructure (three septic systems, one water well and one driveway), which reduces the members' environmental impacts. Three other homes are under construction now. The homeowner's association, "Perennial Field," is preserving the land around the houses in accordance with the previous owner's wishes. Meg Dawkins, who is the driving force behind this project, said, "It fits the Smart Growth Model that the town of Calais has adopted, due to clustering the homes within 3.65 acres and never developing the remaining 25 acres but managing it using regenerative practices, for example, rotational grazing."

As mentioned in the previous articles, Matt Lutz, their architect, was brought in very early and helped them to select a high-end envelope, a sustainable design, and to limit the need for mechanical equipment, thereby reducing their carbon footprint and operating costs. They chose to use the Passive House standard (PHIUS.org) to guarantee their outcomes, guide the details of their choices, and provide them with a certification of the value of their home when finished. Chris Miksic, was chosen to be their Certified Passive House Consultant (CPHC, Montpelier Construction), helped Meg and John choose environmentally conscious methods, materials and appliances to build their fossil fuel-free home.



The Dawkins Passive House in Maple Corner, Vermont. (Courtesy photos: Montpelier Construction).

Like practically everyone who builds a home, the Dawkins had to make some hard choices. (As their architect said, "Cost still makes the big decisions at the end of the day.") But by building to a high-energy standard, they cut their built-in energy costs severely. By choosing to put money into the design and structure, they claimed long-term energy savings that will help them afford to make smaller improvements later. For example, the high-quality building envelope was something that they chose to do up front, knowing that their energy and maintenance savings would allow them to add such things as screened-in porches later on. Efficiency Vermont helped with incentives and free professional advice along the way (bit.do/evt-hphp).



The Shou sugi ban siding.

The house features R-52 double stud wall construction containing 9.25 inches of dense-packed cellulose and then a continuous layer of 4.75 inches Gutex wood fiber insulation board over the outside wall, which makes it safer than traditional construction (which often uses plywood). The R-113 roof is insulated with 30 inches of loose-fill cellulose. Under the slab is 10 inches of EPS foam (recyclable and clean), surrounded by

a R-40, two-foot-wide anti-frost apron extending four feet around the corners, all of it sloped to carry water away from the house. The windows are triple-pane Klear-

wall and are taped to the moisture-controlling membranes surrounding the structure.

This initial investment in a high-performance envelope reduces monthly energy costs severely. And hitting the sweet spot of Passive House means that the sun, heat from appliances (computers, fridge, cooking, etc.) and, amazingly, body heat are major factors in the heating. (One of our favorite 'PH' stories

tells of an elderly woman in Europe who invited friends over on cold days, which warmed up her house.)

The total annual electrical load (plug loads, hot water, ventilation, cooking, lighting, heating and cooling) for the Dawkins house is about \$800 a year compared to an average of \$4,500 for a traditional home. (Ka-ching! There's their screened-in porch.) Energy Star appliances, an induction cooktop, and LED lighting provide additional savings. They've decided not to have a clothes dryer or dishwasher. And they've

used low-maintenance materials, such as a polished concrete kitchen floor. (There is no need for a heated floor in a Passive House, another energy and maintenance savings.) They finished the exterior siding through a process called Shou sugi ban (bit.do/mcph-ssb), which requires very little maintenance.

When Meg and John install their small 5.5kW solar electric system, their energy expenditure will be reduced to net zero. That is, they're investing some "extra" money in their home and in their future at the beginning instead of spending more money on fuel, with no return, for the life of the home. (Also, the maintenance and replacement costs of fuel-burning appliances are far greater than those of solar and electric appliances, not to mention the dangers of having volatile fuels stored in and around the house.)

According to the Dawkins, "Our major accomplishment is that of having a highly energy-efficient and naturally-lit house.

Due to the contributions of our architect, Matt Lutz, and our builder, Montpelier Construction, we now inhabit a home that is visually stunning and inspires people to explore it and ask questions."

Barbara and Greg Whitchurch are Board members of Vermont Passive House (VTPH.org) and have their own Passive House in Middlesex, VT (bit.do/phc-vtbiz & bit.do/mdx-mec-bldg). ♻️



The light and airy kitchen (Whitchurch).

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ENVIRONMENTAL TIPPING POINTS



John Bos

A tipping point is that magical (or malevolent) moment when an idea, trend, or social behavior crosses a threshold, tips, and then spreads like wildfire. A single sick person can start an epidemic of the flu. Or a Twitter meme. Or a single sick person like an authoritarian president can contract COVID-19, the worldwide pandemic he deliberately ignored and then lied about.

We have reached not one, but multiple tipping points in 2020. Tipping points occur in our personal lives, our political lives and in our lives on the planet. Not our planet, the planet. If we really felt that it was ours, we'd take much better care of it.

The environment has its own tipping points.

While the American collapse in political terms is directly attributable to the current climate of poisonous political partisanship fueled by a White House steeped in climate denial, the collapse of our global environment may now be inevitable. There are fifteen known global, climate, tipping points that regulate the state of the planet, and nine of them have been activated.

Australian National University emeritus professor, Will Steffen, told Voice of Action that there was already a chance that we have triggered a "global tipping cascade" that could take us to a less habitable "Hothouse Earth" climate, regardless of whether or not we reduced CO2 emissions.

Steffen, Down Under's leading climate scientist, says it would take 30 years at best (and more likely 40 to 60 years) to transition to net-zero emissions. But when it

comes to tipping points such as Arctic sea ice, we may have already run out of time.

Evidence shows we will also lose control of the tipping points for the Amazon rainforest, the West Antarctic ice sheet, and the Greenland ice sheet in much less time than it's going to take us to get to net-zero emissions, Steffen maintains.

"Given the momentum in both the Earth and human systems, and the growing difference between the reaction time needed to steer humanity towards a more sustainable future, and the intervention time left to avert a range of catastrophes in both the physical climate system (e.g., melting of Arctic sea ice) and the biosphere (e.g., loss of the Great Barrier Reef), we are already deep into the trajectory towards collapse," said Steffen.

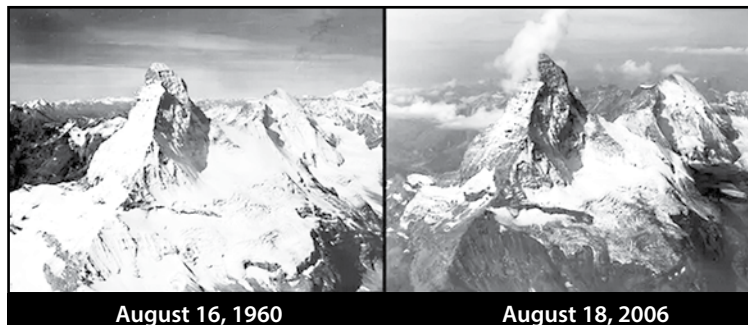
"That is, the intervention time we have left has, in many cases, shrunk to levels that are shorter than the time it would take to transition to a more sustainable system.

"The fact that many of the features of the Earth System that are being damaged or lost constitute 'tipping points' that could well link to form a 'tipping cascade' raises the ultimate question: have we already lost control of the system? Is collapse now inevitable?"

Steffen argues that the intervention time left to prevent tipping could already have shrunk towards zero, whereas the reaction time to achieve net-zero emissions is 30 years at best. Hence, we might already have lost control of whether tip-

ping happens.

Where you stand politically is a major determinant in whether or not you believe in the climate crisis. While the majority of Americans have now come to see climate change for the existential threat that it is, Republican voters lag behind. Fewer than two in five (39%) consider environmental protection to be something they care about, and just 21 percent consider it to be a top priority according to the Pew Research Center. By comparison, 78 percent of Democrats view climate change as a top priority heading into this election cycle.



Matterhorn, one of Europe's tallest peaks, in the Alps on the border between Italy and Switzerland, is eroding as a result of glacial meltwater at the summit. Photos from NASA's "State of Flux" series show courtesy of the Panopticon Gallery, Boston, MA.

The winds of belief, however, may be shifting. As hundreds of wildfires recently tore through 1.2 million acres in Northern California, the cultural conversation took an apocalyptic turn. The conflagrations had the unexpected effect of drawing people with opposing political views closer together.

A recent survey conducted by Stanford

University's Bill Lane Center for the American West suggests that personal experience with wildfires may lessen partisan gaps over climate policy. As global climate change induces more frequent and intense climatic events, the frequency of objectively personal experiences with extreme weather-related events like wildfires may help to reduce partisan gaps over climate policy.

This might be a positive tipping point in the decades-long efforts to persuade the public that we are all, no matter where our political, religious and economic belief are rooted, facing an existential and environmental emergency.

I find myself wondering what the tipping point was that persuaded all the passengers on the "unsinkable" Titanic that they were all going to die. Unless they could secure a space on one of the lifeboats.

There is no silver bullet, no magical Noah's Ark to hold everyone in our foundering world. We, all of us, every single country, must agree on what capacity the climate-crisis lifeboats need to have to keep all of our heads above water, what they

should look like, and how to build them quickly.

John Bos is a contributing writer to Green Energy Times, Citizen Truth and other publications. He has been studying and writing about the political avoidance of global warming for ten years. Comments, factual corrections and questions are invited at john01370@gmail.com. ♻️

The Task Before Us



Dr. Alan K. Betts

There is a grim set of connected issues shaking the stability of the United States as the federal government crumbles in the face of COVID-19, white racism, capitalist exploitation of the poor and the Earth, political bribery and the denial of science and climate change. Many themes are haunting.

Out in the real world, the hurricane season has hit new records with 25 named storms in 2020. Many storms hit the gulf coast. There have been catastrophic fires across the western U.S. exacerbated by climate change. One Oregon state senator, who opposed climate change legislation, returned to find his home burnt to ashes. For humans, this is poetic justice, but for the climate system, this is just reality.

The Siberian forest and peat are burning; the permafrost and Arctic sea-ice are melting and irreversible changes are setting in. Across a vast area of Russia, temperatures in the first six months of 2020 averaged more than ten degrees above the climate of twenty years ago. On the summer solstice, one town within the Arctic reached 100 degrees F.

Globally, 2020 will be one of the warmest years on record, as global climate change is accelerating. As more heat is stored in the oceans, ancient Arctic ice shelves are melting and warmer sea water is undercutting the huge Antarctic glaciers, which will flood our coasts in the coming decades.

The United States, after withdrawing from the 2015 Paris climate-change agreement, is not simply avoiding these issues but heading into a new dark age. Under the cover of COVID-19, President Trump is taking multi-million-dollar bribes from polluting industries to roll back EPA clean air, clean water and cleaner car regulations, because he needs money for re-election. The 1970 establishment by President Nixon of the Environmental Protection Agency, and the Clean Air Act the same year were real achievements, as were the Clean Air Act extensions passed by President George H.W. Bush in 1990, just 30 years ago.

G. H. W. Bush was the last Republican president that really listened to scientists. Following Reagan, he was responsible for extending the Montreal protocol, the global regulation that saved the Earth from an ozone catastrophe. G. H. W. Bush fully understood that society must pay to protect future generations from pollution. In contrast, the shocking actions of the current president and his advisors in rolling back pollution regulations for ready cash are simply despicable; as this condemns hundreds of thousands of children and older people to sickness and death.

The glaring issue is that our society no longer places much value on the future, because capitalism has become increasingly focused on maximizing current profits for corporations and the wealthy. Most capitalist

economies, such as those in Europe, include the future costs of pollution as real costs for doing business. Here in the U.S., rich corporations, the fossil fuel industry and right-wing politicians have conspired to pretend the future of our children and the future of the Earth have no value. In simple terms they are refusing to take any responsibility for the future. Once the U.S. claimed it stood for freedom, responsibility and justice (at least for white racists). Now the U.S. capitalist economy simply prizes the freedom to exploit the poor and the Earth for profit.

For example, we hear that paying fees now for future climate damage is not 'cost-effective'. This is warped logic. We care deeply for our children in the present, so why are we so willing to sacrifice their future lives to increase current profits a little. When will we start asking the honest question: "Is this cost-effective for our children?"

As the COVID-19 pandemic spreads again across the U.S., the political

response has been dismal. We hear the strange rationalization that freedom not to wear masks is more important than the spread of the virus. This is not freedom coupled with responsibility. Where in the U.S. constitution does the freedom to spread diseases that kill people appear? Of course, government denial of the reality and science of COVID-19 has played a large part.

Another haunting group are the right-wing Christians who backed slavery and then white racism for nearly a century after the Civil War. Now they are encouraging the white racist views of the president. Where is their compassion for the suffering of the poor during this pandemic? Are they concerned for women and children as climate change threatens our grandchildren? Contrast the example of the black Baptist minister Samuel Sharpe, who called 60,000 Jamaican slaves out on strike for half-pay on Christmas Day 1831. He was executed for treason, but his clear Christian stance led directly to irrevocable freedom for all the slaves across the British Empire.

Yes, we have much to do. So, take a deep breath and step out into the beauty of early winter. Breathe again and connect with the whole of the Creation, and resolve to preserve it. Encourage schools to hold classes outside on sunny days, so children can learn immersed in the natural world. Resolve to stand together for freedom, responsibility and justice for all. ♻️



Climate Movement. Image: Wikipedia

Floating with the Ice Across the Arctic

Alan Betts

The largest polar expedition in history to study the melting polar ice sheet ended on October 12, 2020. It was called MOSAiC, standing for The Multidisciplinary drifting Observatory for the Study of Arctic Climate. It started in September 2019, when the German research icebreaker Polarstern sailed north from Tromsø in Norway into the Arctic to drift with the Arctic currents and ice for one year. This expedition started in September when the sea-ice cover is at a minimum and the ice is thin, so the ship could get the farthest north, before it was frozen into the ice for the winter. Instruments were set up a mile or so away from the ship to drift on an ice flow along with the ship, as they took measurements through the Arctic winter close to the North Pole and beyond. Observers had to watch all the time for curious and perhaps hungry polar bears, as they checked instruments and studied the ecosystems beneath the relatively thin ice.

The Arctic is changing rapidly as it warms twice as fast as the Earth as a whole. The Norwegian researcher and explorer Nansen set sail 127



A guard stands watch looking for polar bears in early January. Credits: Alfred Wegener Institute, Lucas Piotrowski. CC-BY-SA 4.0 (<https://bit.ly/38OKcvq>).

years ago on the first ever drift expedition with his specially built wooden sailing ship Fram. His expedition lasted from 1893 to 1896. Last winter's Arctic temperature were 18 degrees warmer than what Nansen measured. The polar ice is much thinner now, heavily fractured and full of holes.

Why is the Arctic changing so fast? As you know the Earth is warming as the burning of the fossil fuels, leaking methane wells and other human sources pour greenhouse gases like CO2 into the atmosphere that slow the cooling of the Earth to space at night. More than 90% of this trapped heat is stored in the oceans. Think of this as the trigger that drives a series of amplifying effects. As the oceans warm, more water evaporates, and water vapor is a very powerful greenhouse gas that triples the warming by

CO2 alone. This happens on a global scale. But in the Arctic, much more happens. The warming melts the polar ice that reflects most of the sunlight, and exposes the ocean which absorbs most of the sunlight. Sea-ice doesn't evaporate, but the ocean does, so water vapor in the air increases, and more clouds form. Both more water vapor and clouds trap more heat. Collectively all these processes -- the loss of ice reflecting sunlight, more heat stored in the oceans, more water vapor and clouds in the air -- double the warming of the Arctic over time. The ice cover is shrinking -- this September the area covered was the second lowest on record -- and the ice is getting thinner and thinner. Ice used to get thicker every winter and last for years. Now most of the Arctic ice is only one year old and only a few feet thick.

crumpled.

For us on land, our winters are warming twice as fast as summers for similar reasons. As winters warm, there is less snow cover to reflect sunlight, and if the ground is wet rather than frozen, more water vapor evaporates into the air, slowing the cooling to space. The big question for us is whether humanity could control the greenhouse gases and move away from burning 100 million years of fossil fuels in about a century. But driven by greed and the focus on current profits for the wealthy, we condemn



our children and the Earth to the tragedies that lie ahead as the ice-sheets melt.

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

To Reach the Spring

From Complicity to Consciousness in the Age of Eco-Crises

Nathaniel Popkin

New Door Books, December 2020, 148 pages, \$15.95

Book Review by Steven Strong

Nathaniel Popkin refers to the chlorofluorocarbons (CFCs) in the atmosphere, plastics in the ocean, permafrost melting, glaciers receding, ocean temperatures rising, thousands of species going extinct, massive wildfires around the globe, more frequent and powerful typhoons and hurricanes - all accelerating climate change, as creating a "Hyper Object."

A Hyper Object is one so massive in scale and all-encompassing that our civilization is unable to take action. Since the United Nations' Earth Summit in Rio de Janeiro back in June of 1992, little real progress has been made in even agreeing on a global path forward, let alone following that path.



Author Nathaniel Popkin

While some progress is being made in individual initiatives, essential global consensus is drifting further out of reach. Authoritar-

ian leaders are actively accelerating the crisis in the quest for profits. Brazil's President Bolsonaro has declared open season on plundering the Amazon Rain Forest while Donald Trump has opened U.S. coastal waters and the pristine Arctic Wildlife Refuge for the oil companies to desecrate.

Popkin cites capitalism as "invading every aspect of life on earth" where green shoots of concern and demand for action are smothered by an unending torrent of disinformation from powerful multinationals. These are led by the fossil fuel industry and supported by enabling politicians, that cast doubt on the very reality of the crisis facing our planet.

Drawing on his years of experience as a climate activist and referencing past world crises from the bubonic plague of the dark ages to our Covid-19 pandemic, Popkin shows how challenging it is to achieve consensus on climate action and then shows us why we must.



Compounding resource extraction coupled with exponential economic and population growth is simply not possible on our finite Earth. What will be left for our children and our grandchildren?

By illuminating how our reverence for Earth is intrinsically connected to our capacity to hope and to heal, leading to an inexorable yearning to act, Popkin has offered us a way forward. Popkin's *To Reach the Spring* is a needed

clarion call to climate action.

Steven Strong is Founder and President of Solar Design Associates, a firm of engineers and architects working world-wide to make renewable energy mainstream. He is the author of *The Solar Electric House and Solar Electric Buildings*, an Overview of Today's Applications and the editor and contributing author of *Photovoltaics in the Built Environment*, a Design Guide for Architects and Engineers as well as contributing author to *Green Design - From Theory to Practice with architect Ken Yeang*.

HISTORIC PH RETROFIT

Cont'd from p.24

of the concrete panels acts as an air barrier and vapor retarder and provides a high R-value for the walls and roof. The SWA Enclosures team provided detailing of the continuous thermal breaks (aerogel-containing spray, tape, and insulating blocks) and condensation control for tight spaces around window and door openings in order to maintain the historic fabric while achieving Passive House and LEED goals. Selecting triple-pane windows that most resembled the existing historic windows will aid in airtightness and overall efficiency of the building.

In addition to the aggressive energy goals of this project, the preservation of the building's concrete shell and mixed concrete and steel structure creates a much lower embodied carbon impact than if the building had been demolished, contributing to an increasingly important conversation about carbon emissions associated with building and materials.

SWA is proud to take part in the efforts to preserve this historic building and to create a healthy and comfortable environment for future occupants. As our team continues to consult on the project, we will be sharing the project achievements, so be on the lookout for a follow up on the embodied carbon and other LEED highlights.

Kate Doherty is a Building Systems Analyst, and Dylan Martello is a Senior Building Systems Consultant. Both work at Steven Winter Associates, Inc.

Thin Triple-pane Windows Brighten U.S. Market

Wendy Koch

Windows have advanced considerably over the decades, from drafty single-pane models to much better double-pane ones. Now, over just the past two years, thin triple-pane windows that offer a lot more insulation have entered the U.S. market. Such technology enables homes and buildings to save even more energy while being comfortable and bright, with plenty of windows.

"Windows are how we connect to the outdoors," says Robert Hart, principal scientific engineering associate at the Lawrence Berkeley National Laboratory, adding that they have a great impact on energy use and occupant comfort. Yet, he says, windows typically used today are the "poorest thermally performing part" of the building envelope, potentially resulting in drafts, condensation, or overheating.

Hart is part of a Department of Energy-funded team that is working with organizations and manufacturers (including makers of the new thin triple-pane windows — Anderson Corporation, Ply Gem, and Alpen HPP) to develop better windows, scale production, and reduce costs. We talked to Hart about this work and the Summer Study paper, "Innovative Market Pathways to Promote Adoption of High-Performance Windows," that he co-authored with the team.* Here are excerpts of our conversation:

Double-pane windows are often the norm. How are triple-paned ones different?

They are more insulating. In fact, the triple glass element with gas fills and low-emissivity (low-E) coatings can be twice as efficient as a double-pane low-E unit. This thermal improvement leads to several benefits. They keep room-side surface temperatures closer to the room air temperature, meaning they significantly reduce the risk of condensation on cold nights and are more comfortable to be next to on both hot and cold days. They also lose less heat to the outdoors, making homes more energy efficient and resilient.

Conventional triples are widely used in Northern Europe but represent less than 2% of the U.S. market. Our "thin triple" design is intended to make it easier and more cost effective for window companies



Highly insulating windows, like this triple pane window, can help reduce heat loss in residential and commercial buildings. Photo courtesy of Pacific Northwest National Laboratory.

to switch from today's standard R3 double glazing to R5 triple-glazed windows.

What can you tell us about the thin triple-paned windows that recently entered the U.S. market?

The current offerings range from products designed for new construction production builders to products for high-end retrofits. Due to the current market conditions with COVID-19, they are all making a slow launch, but we are still very excited to see these products finding their way into the market. Two of the companies are represented in the top five of national residential sales, so they have the potential to make a large market impact.

Are these windows more expensive, and will they work in all existing homes and buildings?

Highly insulating windows, such as triple-pane windows, are good candidates to be used in most U.S. climates. The lowest possible cost for triple-pane windows will always be more than the lowest possible cost for double-pane windows, simply because there is more material being used. But we know the material costs at the manufacturer's plant are low, and we also know that the current cost difference to consumers is much higher than it could be because the designs aren't

optimized and because production volume for triple-pane windows is so low.

We recently had a German window manufacturer visit our lab and she described to us how double-pane units from their factory cost more than triple-pane units because they are set up to make triples in volume, while doubles are considered special order products. This could be in the future for the United States, as well.

What are the biggest obstacles and opportunities for scaling the use of thin triple-pane windows?

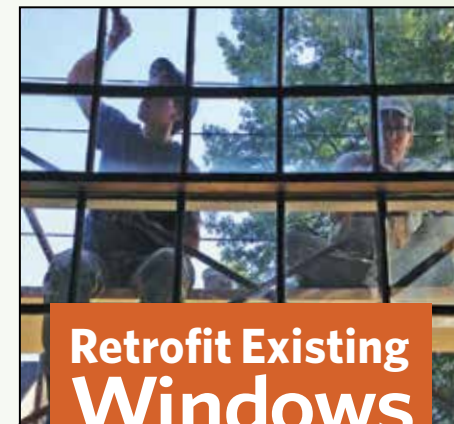
The biggest obstacle is cost, which is related to volume, as noted above. The path to successfully gaining high market penetration, and therefore reducing the cost, is to initially identify opportunities where cost is less of an obstruction to adoption. In new construction, there are opportunities where using triple-pane windows as alternative means of code compliance in place of other mandatory envelope measures can actually reduce construction costs. With retrofits, where sales are often made directly to the occupants, the incremental cost of triple-pane is less of an obstacle. If better windows allow HVAC to be downsized, that's another savings opportunity.

Given the improvement in windows, do new homes or buildings need to reduce the number of them to achieve net-zero energy use?

Not at all! In fact, they could use more windows. They just need to use better technology solutions than the windows typically used today. I have a favorite slide I always like to show in presentations of a home without windows — I haven't met anyone yet who wants to live in that home!

High-performance windows used in conjunction with smart building envelope design, such as external shading and passive solar harvesting in cold climates, can allow buildings with large areas of windows to use less total energy than buildings with no windows at all. In commercial buildings, the daylight from windows also offsets electric lighting energy use. We call this concept net-zero or zero-energy windows.

Wendy Koch is the senior director of marketing and communications for American Council for an Energy-Efficient Economy (ACEEE).



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*The paper's co-authors are Stephen Selkowitz, affiliate, Lawrence Berkeley National Laboratory; Marc LaFrance, U.S. Department of Energy; Katherine Cort, Pacific Northwest National Laboratory; Maziar Shirakh, California Energy Commission; and John Jennings, Northwest Energy Efficiency Alliance.

Reprinted with permission. This was originally posted on July 31, 2020 at <http://bit.ly/ACEEE-TriplePaneWindows>. ♻️



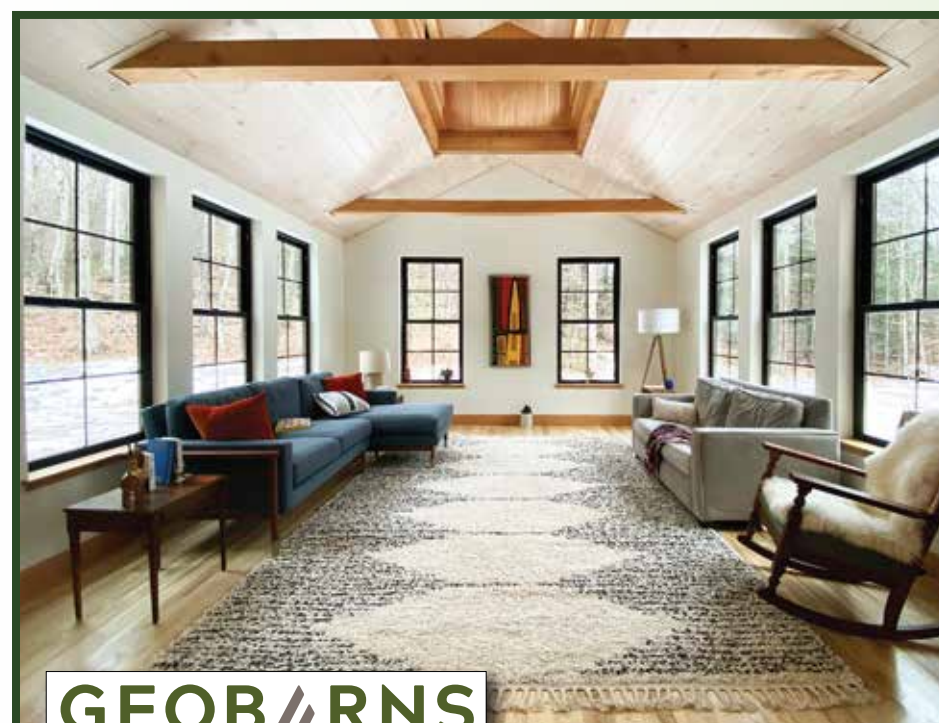
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New Frameworks and Glad Tidings of Innovation at Happiness Hill

Taylor McNeely and Ben Graham

Marshfield, Vermont

At the Happiness Hill homestead in Marshfield, Vermont, there is much to celebrate and be happy for. Through the vision of talented builders and innovators, what began as a humble off-grid 900 square foot home, was transformed into a roughly 2,000 square foot, fully functional state-of-the-art residence that requires very little maintenance.

During the 1990s the original 12-by-12 cabin was erected. It was then moved from its original site to Ennis Hill Rd. in Marshfield, where it underwent the construction of an addition that incorporated the cabin as a detached space connected by the new entry deck.

The second and most transformative addition was built by New Frameworks, which is a worker-owned cooperative committed to kinder and ecologically-minded building practices and comprehensive, full-service systems design. The New Frameworks addition was built to embody the ecological and social responsibility that protects the environment of the home and those that dwell within it. The process of the work at Happiness Hill is a wonderful example of a phased project. It is a place where the inhabitants assumed creative control and affordability by growing their space as their finances would allow.

Renewable Energy

The addition at Happiness Hill upgraded the existing off-grid 600W solar PV system to a 4kW grid-tied photovoltaic system. The existing house used both a solar hot water collector and an exchange coil coming from the woodstove for domestic hot water supply. This system works well and continues to serve the addition built by New Frameworks. One of the most exciting parts of the addition is that no additional heat load was required to serve the new square footage. Due to the excellent quality of the enclosure, the same amount of energy that heated 900 square feet now heats 2,000 square feet.



Fitting its surroundings. Photo: Stina Booth.

Renewable Materials

Using renewable materials lay at the heart of the addition design. In particular, the use of the "Strawcell" wall. Created with locally-harvested stacked strawbales coupled with densely packed cellulose, Strawcell walls are affordable, easy to construct and have a natural resilient durability. Straw fiber has proven to be a long-lasting quality insulation material when designed and installed properly for the climate.

Using natural, renewable materials reverses the unpredictable hazards of materials that are made from the by-products of fossil fuels. The entire design of the Happiness Hill addition eliminated the use of foam and other petrol-based materials in exchange for renewable, natural, and recycled materials that perform as well, if not better.

High-Performance Renewable Assemblies

The performance of a home can be measured by the quality of its enclosure. A home that can hold in its heat is just as important as producing that heat efficiently. Heat can escape an enclosure most readily at points of air leakage. It was critical to ensure the walls be not only super-insulated but airtight as well.

Strawcell walls are super-insulated, with an R-value of 50 (R-50), and are more airtight than traditional strawbale walls.

New Frameworks developed the assembly system of the Strawcell wall to work in our cold, wet northern climate. They are made locally, renewably, and the Strawcell wall can compete within the conventional building market. The Strawcell wall system was presented at the 2013 NESEA Building Energy conference in Boston.

Climate Restoring Design

As super-insulated construction becomes more mainstream, the Strawcell wall system will stand out as one that is not only made sustainably, but one that can sink carbon. As the straw grows, it pulls carbon from the air and not only stores it in the soil but also in its stalk. When harvested and installed into a Strawcell wall, the carbon is then stored for the life of the building. The

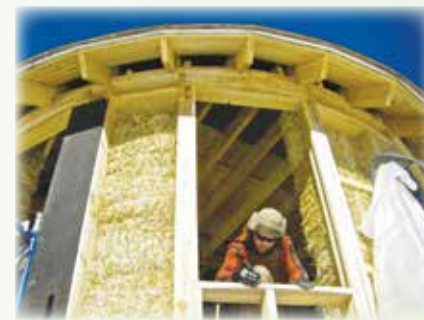
materials in this wall system have shown to last, when properly designed and detailed, for many decades, safely storing the carbon out of the atmosphere where it is a driver of climate change. The life cycle of this style of wall has a very small footprint, as it is able to quickly and fully compost at the end of its useful life within a structure.

Cost and Carbon Savings

Unfortunately, there is currently no incentive for the carbon savings performed by structures such as the Happiness Hill home. There are positive signs that there may be some form of an appraisal metric in the near future that will value this aspect of the real estate market. While Efficiency Vermont does give incentives for new appliances, appraisal values barely reflect energy efficiency. Happiness Hill will be even more fully appreciated if and when this occurs.

Legacy Building

Happiness Hill is a legacy project that will benefit more than the current owners. Sustainable durability is a design element that will ensure not only a long life to the home,



Happiness Hill under construction. Photo: New Frameworks.

but one that is high performing and high quality. The beauty of Happiness Hill's breathtaking setting helps one to feel that the ethic and preservation of this homestead will be a promise that is kept by generations to come. It's an asset to the dweller, likewise to the larger community as a model of quality and efficient, residential construction.

Climate action in the building industry not only means building new homes with high performance and low environmental impact but also working diligently to innovate ways to upgrade and renovate existing buildings with health and environmental justice in mind. With more holistic intentions such as these, perhaps, we could make any hill with a home just as happy.

Ben Graham is the co-founder and Design Director with New Frameworks, based in Burlington and Montpelier, VT.

Taylor McNeely is a woman who likes to sit by a fire and knit. She is also an artist and writer based in Montpelier, VT. ♻️



Spacious Interior. Photo: Stina Booth.



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Just A Bunch of B.S. (*Building Science, of course)***Windows in Winter: A Cool Little Microclimate, Part 2**

Nate Gusakov

It's a rough life being a window here in the Northeast U.S. You're expected to let light in and out, heat in but not out, and, in addition, you have to morph from being a wide-open hole in the wall into transparent, blizzard-proof armor many times a year, and you're usually supposed to look good while doing it! That's a lot to ask. In the last issue I wrote about the convection loop that can develop near our window panes in the wintertime, carrying cold air down onto the couch and tricking us into thinking that the window is leaky. This column is about another (perhaps more troubling) issue with windows in winter: condensation on the bottom of the panes.

To understand the phenomenon, we can return to the basic principle of condensation: **Condensation occurs when warmer, moist air meets a cooler condensing surface below its dew-point.** The inside environment of a house has many direct sources of moisture that are constantly dumping water vapor into the air: our breath, evaporation from showers and laundry, cooking, etc. As this warm moist air makes its way down the windowpane (there's our old friend the convection loop again), it gets cooler and cooler until it just can't hold that water vapor anymore and releases some of it on the nearest available condensing surface: the bottom of the pane.

The classic, curving-up-the-side shape of this condensation (see picture) has to do with the surface temperature of the different regions of the pane of glass.

The edges of the pane are colder – they are closer to contact with the frame material which acts as a thermal bridge, conducting outside cold into the glass. Why then does the condensation only form at the bottoms of the panes and not all the way around the edge of each one? Now that's



a good question. I think the answer lies in the orientation. If the window were to be completely horizontal but still to the exterior (i.e. through the flat ceiling or floor, looking at the outside), I think it would condense equally around the edge of each pane. Because most windows are vertical, the good ol' convection loop drives the process downward. In addition, gravity draws any condensation at the top of the pane down towards the warmer center of the pane where it likely re-evaporates before really becoming visible. Conversely, at the bottom of the window gravity is drawing any condensation farther down toward the colder edge and so the beads of water grow in size as they're pulled downward. The real




Condensation on a window. Ozgu Ozden, Unsplash (<https://bit.ly/3kylUUV>).

trouble begins when all this condensed moisture settles in at the bottom of the window as liquid water and then stays there consistently throughout the winter. If the window frames are wood, this water will first stain and then help rot the wood. Regardless of the frame material, this water will serve as a great little petri dish for mold.

So, what's to be done? Proper household ventilation is a critical first step—help all that moisture get out of the house in a safe way instead of milling about and condensing on things! Even drying the air won't help all the time, though. Regardless of ventilation, humans generally become

uncomfortable as a house's air gets too dry. Federal recommendations (ASHRAE) are to keep indoor humidity levels between 30%-60% for best health, and many folks become uncomfortably dry as levels approach 40%. I've noted significant condensation on our windowpanes (modern double-pane) even when a hygrometer right there on the windowsill was reading 30% RH! The next simplest answer is to warm up the surface of the window pane. Triple-paned windows do this by adding yet another insulating glass and gas sandwich layer between the inside pane and the outside air. Installing plastic window film (see last issue's column) will perform a similar function for a fraction of the cost. There are even products on the market that plug into a wall outlet and stick onto the bottom of the window pane to warm up the glass with electrical resistance heat. At the very least, be sure to check for any staining or mold growth and clean it well with a fungicidal cleaner on a regular basis.

As building science continues to develop, and we continue to build tight houses that hold moisture better than the drafty old farmhouses of a few generations ago, new answers to the problem of window pane condensation will be developed. You got one?

Nate Gusakov is a BPI-Certified auditor, home performance contractor, and energy consultant for Zone 6 Energy in New Haven, VT. 

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Efficiency Vermont's EEN Contractor Spotlight: GSK Climate Control, Inc. of East Dorset, VT

Interview with Taylor Kristiansen, Secretary and Technician

Green Energy Times Staff

1. What is your area of expertise?

GSK is a full-service mechanical contractor that serves both commercial and residential customers. We specialize in design-build heating, ventilation, air-conditioning, plumbing, commercial refrigeration, and custom sheet metal fabrication.

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

Any project that involves installing, wiring, or servicing a HVAC system should be left to certified professionals. There's a lot that can go wrong when homeowners attempt to DIY electrical work, combustion appliances, refrigerant handling, refrigeration systems and controls. It is not safe and puts building occupants' lives, comfort, and health at risk.

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

Here in New England everyone needs heat. Upgrade your home or building's heating system to a 95-98% Annualized Fuel Utilization Efficiency (AFUE) appliance and add a smart programmable thermostat. Even just adding a programmable thermostat can save between 10-15% on energy consumption. We've also been installing a lot of cold-climate heat pumps. These eliminate a homeowner's



Taylor Kristiansen, Secretary and Technician for GSK Climate Control, Inc. of East Dorset, VT. Courtesy photo.

dependence on heating fuels, onsite fuel storage, and the carbon emissions combustion appliances produce.

4. What in your field of specialty is most valuable for our readers to know?

As an HVAC/R and plumbing contractor, everything we do directly correlates to energy efficiency. From reducing water consumption with low-flow plumbing fixtures, hot water recirculation systems, and leak-detecting devices, to reducing fuel consumption and carbon footprint with energy-efficient HVAC appliances and controls, to creating a cost-effective environmentally-friendly refrigeration system with state-of-the-art compressors, defrost management, and remote control/alarms. Everything we touch directly impacts the environment and the comfort of building occupants.



5. Why should people use an Efficiency Excellence Network (EEN) contractor over someone else?

EEN members are committed to providing the highest quality energy-efficient services to their communities. The EEN network vets all their contractors and requires annual continuing education to keep the EEN contractor status. EEN also provides quality resources and support, as well as rebate incentives and even custom rebates for our commercial clients. EEN members are also able to provide the added benefit of project financing through state initiatives.

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

Efficiencyvermont.com/rebates lists all the current rebates in the state. Efficiency VT and Green Mountain Power are currently offering rebate incentives for both commercial and residential heat pumps. Although the heat pump rebates were recently reduced at the end of August this year, they are still sizeable. Efficiency VT currently offers rebates on commercial and residential ventilation systems, centrally-ducted heat pumps, heat pump hot water heaters, smart thermostats, variable frequency drives (VFD's), high-efficiency circulators, efficient evaporator fan motors, and high efficiency evaporators for commercial refrigeration applications – to name a few. [Editor's note: see the Incentives section on page 14 and 15 for more details.]



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

Ask your friends and neighbors about reputable contractors in the area – almost all of our referral business is word-of-mouth. Determine how long the contractor has been in business and how experienced they are with the scope of your work. Keep system manuals and documentation, including blueprints, in a neat binder, booklet, or easy to share USB. Ask about creating a preventative maintenance plan on the new equipment you're having installed. Preventative maintenance is so important, as regular cleaning and inspection will prolong the life of your equipment and optimize the efficiency of your system. In most cases neglecting to follow through with preventative maintenance will void the warranty on your equipment. Lastly, ask your HVAC contractor if there are any improvements you could make to the building envelope that will help minimize the heating and cooling load, in turn, decreasing energy usage and possibly the size and cost of your HVAC system. ♻️



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SUMMER PARK AT HANOVER

AFFORDABLE EFFICIENCY IN HANOVER, NEW HAMPSHIRE

Barbara and Greg Whitchurch



Summer Park Residences in Hanover, NH, is a Passive House certified, affordable housing building for seniors and those with disabilities. Twenty-four units are open with eighteen more under construction. Photos: Banwell Architects.

The Northeast is experiencing a housing crunch. Young families, college students, and new arrivals are looking for affordable places to live. Beyond these normal pressures, increasingly severe weather events, and disease outbreaks exacerbated by the climate crisis, have accelerated the predicted climate-driven migration to the Northeast (bit.do/get-cc-migration and bit.do/get-cc-migration2).

Instead of adding unsustainable "cheap" housing to the ever-spreading suburban sprawl that further stresses the climate, Twin Pines Housing (TwinPinesHousing.org) is creating sustainable, affordable housing in the heart of communities to help solve that crunch. Their goal is to develop, own and manage good-quality, affordable housing located where it is needed, close to existing amenities and facilities -- post offices, libraries, grocery stores, and public transportation.

Right now, they are opening the 24-unit Summer Park Residences in Hanover, NH, for seniors and those with disabilities, their newest in a long series of multi-family affordable housing developments. Residents are already moving in. An 18-unit addition will begin construction in November for a total of 42 units by next fall. (Two of their other projects are bit.do/get-tph1 and bit.do/get-tph2.) Summer Park is but one of several Passive House (PH) certified multi-family buildings in New England.

Twin Pines owns 491 apartments in the Upper Valley region of Vermont and New Hampshire, spanning northern Windsor, southern Orange, and southwestern Grafton counties. Most units are for individuals and families with low to moderate incomes. They also leased a portion of one of their properties for community solar PV to a local homeowner group. They own a mobile home park in South Royalton, VT, purchasing the first Vermod high-performance manufactured home for the park, and they bought more Vermods since (bit.do/vermod). Vermods are manufactured in Wilder, VT.

Twin Pines also offers down payment

grants to help qualified buyers purchase a home in Vermont. In exchange for this grant, homebuyers agree to limit their equity gain should they sell the home. This equity cap allows the home to remain affordable for future buyers. The maximum grant amount is \$50,000 or 20% of the purchase price of the property, whichever is less.

Matt Giffin and Ingrid Nichols of Banwell Architects designed the South Park building to the PH standard with guidance from Chris West of Eco Houses of VT, LLC. Chris is the Certified Passive House Consultant (CPHC) who ran the software that monitored the project. Karen Bushey, CPHC, CPHR, of VEIC was the rater. Matt said that this, their first PH project, came with a number of uncertainties and challenges whose degrees of difficulty would wane with repetition. The federal and state agencies who oversee and provide grants for such

projects also had a learning curve to master in order to bring themselves up-to-date on modern building science practices and opportunities.

By going the PH route, Twin Pines guaranteed that they could hit the sweet spot of affordability, comfort, health and sustainability - as well as qualify for every rebate and incentive available to quality building projects. Twin Pines focused on insulation levels, from underneath the foundation to the roof, air sealing, and a fresh filtered air supply, resulting in greatly reduced maintenance and operating costs. They're placing a solar array on top of the roof to generate about \$7,000 worth of energy per year.

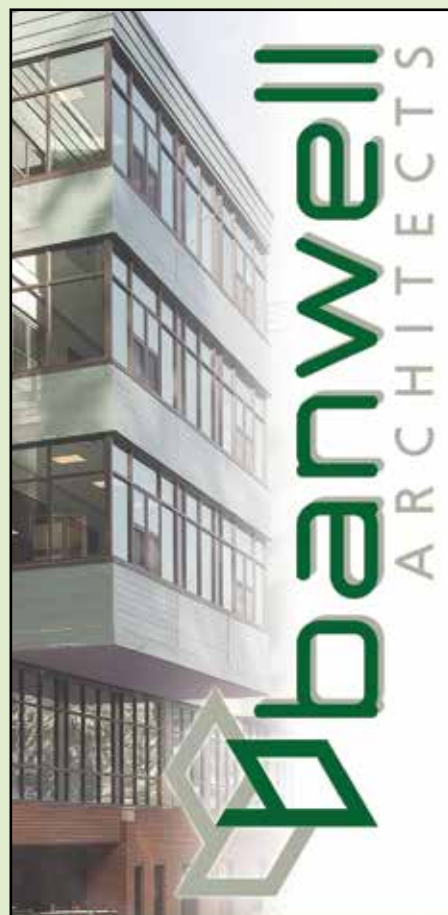
Here are some details. Jeff Ingram of Ingram Construction Corporation was the Construction Manager. This is their first PH project, too. Ian Ingram lived onsite to guarantee the proper sequencing and completion of construction. He was directly responsible for the excellent air leakage result of 0.043 cfm/sq. ft. of

outside wall. The underside of the slab on grade is air-sealed with Stego 10mil vapor barrier with seams taped and penetrations caulked or gasketed. The Stego is taped to the Zip System sheathing (bit.do/zip-sys) on the walls, and that is taped to the Advantec (bit.do/advantec) decking across the roof plane. All windows, doors, and other penetrations



A kitchen at the Summer Park residence, located in the heart of Hanover, NH, features energy-efficient details throughout the development.


Cont'd on p.33



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SUMMER PARK

Cont'd from p.26

are sealed and taped with SIGA.swiss acrylic tapes.

For insulation, the slab on grade is atop four inches of R-20 extruded polystyrene. They Insulation installed the R-24 mineral wool within the wall cavities. Continuous R-28.5 Kooltherm K12 (bit.do/kooltherm-k12) phenolic insulation is sealed and taped on the exterior of the Zip System. An additional layer of three-quarter inch wall sheathing was installed and then covered by Certainteed water-resistant barrier from Perkins Home Center. The vinyl siding was installed by J A Jubb Co. The roof deck is covered with a tapered R-65 Fires-tone polyiso system from The Melanson Company along with a 65 mil EPDM roof membrane which will soon be topped with a ballasted solar PV system from Norwich Solar Technologies. Yeaton Associates engineered the HVAC with Daikin cold-climate heat pumps for heating and cooling, and Ventacity energy-recovery ventilation systems. Each unit has operable awning-type, triple pane windows by Kohltech from Loewen Window Center.



Blower door testing is done to assure that the building meets the high-efficiency standards.

Speaking of COVID-19, the rooms have a slightly negative pressure on their fresh, filtered air so that germ-laden air (and cooking odor) isn't expelled out into the hallways or into other apartments. Should quarantine be necessary, this building is designed to assist.

The Passive House standard is not just for homes. Larger buildings from the Midwest to the east coast are costing below market rate when built to PH. Multi-family apartments, schools, dorms, and libraries built to the PH standard are popping up all over the Northeast. All are far cheaper to operate and maintain than code-built. Since the Passive House software package and the CPHC guide the process through all stages, the fact that this was the first PH project for some of the principals involved was never a threat to the success of the outcome. There are more and more builders, architects, engineering firms and suppliers with experience in this up-to-date and environmentally-friendly choice.

The writers are board members of Vermont Passive House (VTPH.org) and have their own Passive House in Middlesex, VT bit.do/phc-vtbiz. ♻️

NEW ENGLAND IS ALSO ON FIRE

Cont'd from p. 1

of the state's usual summer rain. That's the result of global weather patterns, according to Sean Birkel, a professor of climatology at the University of Maine's Climate Change Institute. Normally, weather systems blow through Maine on their way east, but this summer, a high-pressure zone called a blocking pattern got stuck over Greenland, clogging up the jet stream.

And that could be a sign of what's to come. "It appears that the warming climate is making the jet stream slow down," said Birkel. "But there's an ongoing scientific debate as to why and how these blocking events are becoming more frequent."

Overall, Birkel added, Maine's climate is getting wetter, including the state's summers. But the more intense storms fueled by climate disruption can mean that even while overall rainfall increases, drought still becomes more frequent. In the same way that Maine is seeing more heat waves and winter storms, a summer that's wetter on average might actually look like a series of deluges and droughts.

That would mean greater fire risk throughout the summer, said Patty Cormier, the director of the Maine Forest Service. Prolonged drizzle is much more effective at dampening fire danger—and refilling streams and groundwater—than a heavy storm followed by a drought, which can turn all the greenery fed by that rainfall into tinder.

That's what happened in Maine this summer: After a late spring drought sparked hundreds of fires, a patch of wet weather in mid-summer temporarily reduced the danger. Then a late-summer dry spell put the entire state in moderate to extreme drought conditions for the first time in 18 years, and the fire season came back. Wells began to run dry in June, and according to the Maine Monitor, wildland fire crews have faced challenges even finding water to fill engines.

Most of Maine's wildfires are small, said Cormier. But they're hard to fight and prone to flaring up unexpectedly. She calls them "the sneaky monster."

"Fire goes down into the root systems ... and you're fighting a wildfire underneath the ground. They can burn for a long time without us noticing that they're there." And massive fires aren't unheard of—in October 1947, a series of blazes consumed more than 200,000 acres across the state, leading to huge investments in wildfire fighting capacity.

This year's increased fire risk came at a particularly unlucky moment, as the pandemic brought more visitors to campsites in the Maine woods and sent homeowners into their backyards on the wildland edge, where their thoughts inevitably turned to landscaping. This spring, the Maine Forest Service issued twice as many burn permits as it had the previous spring. "People were home looking at their yards saying, 'I really need to clean this up,' and that led to escaped fires," Cormier said. Ninety-five percent of the fires this year were caused by humans, she said. "We've seen crazy ones. Common sense would tell you not to have a burn pile beside your barn."

Those home-grown fires were accompanied by an increase in escaped camp-

fires, which Cormier attributed to more "first-timers" out in the woods during the pandemic who don't know how much water they have to use to put out a campfire. During drought conditions, she said, it only takes one ember. "Then it's windy, no one notices for a while, and it builds up into a fire."

The X factor

Another challenge is that most of Maine's fire departments are staffed by volunteers and are struggling to find new recruits. Those shortages put pressure on the state's wildland firefighting capacity, according to Cormier. Terry Bell, fire chief in Farmington, a college town in central Maine, is the son and grandson of volunteer firefighters. As a kid, he would listen for the public fire alarms that would alert the volunteer force, and when he heard them, he would jump on his bike and race the department to the scene of the fire. He joined the force in the 1970s and was hired as its first full-time employee in 2002.

"When I got on, there were 40 of us—you basically had to be voted on. There was a waiting list," he said. Now, there are between 20 and 25 firefighters, including the seven full-timers. ("Volunteer" is a slightly misleading term—they do get paid, just on a per-call basis.) Bell estimates the average age in his department as around 50. Many of its volunteers are already over 65. There's one who's 83.

"You can call any fire department in the state of Maine, I guarantee you, and they would have similar numbers," Bell said. That's a problem, because Farmington and the small towns that surround it rely

on each other for extra numbers when fighting large fires.

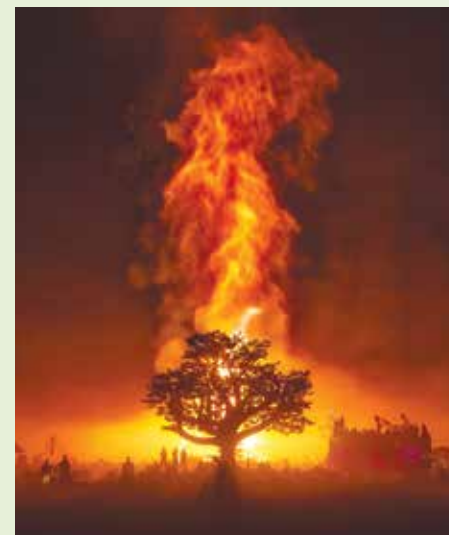
Bell said that departments coordinate recruitment efforts, usually by courting high school and college students who can work in supporting roles. But training takes months, and firefighters need to be on call regularly to develop a working relationship with the crew.

Bell blames the changing nature of work in Maine. "A lot of people can't leave their place

of work now," he said. "Years ago, people used to be able to leave the oil company, or they were self-employed. My grandfather was a plumber." Many of the regulars on his crew are self-employed or work for small companies that are willing to work around firefighting schedules.

Chris Easton has noticed the same thing in Dixmont. He works full-time as a biology professor at Eastern Maine Community College and was able to stay on call this spring because he's working from home during the pandemic. But many other members of his department now work at jobs where it's harder to drop everything and go out on a call. Health care and education have replaced agriculture and industry as the major employers in rural counties.

"Dixmont has been the way Dixmont is for about 100 years," said Easton. "There's about a thousand people in town, and that's the way it's been. But when most of the peoples'



Tree with a burning section of forest land in background. Image: Flickr/Trey Ratcliff



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ELMORE ROOTS' PERMACULTURE KNOW-HOW

Birds

of this Audubon report.)

Yesterday, I was standing on a bridge

David Fried

As soon as I wake up, I hear them singing. Lots of them. Filling the soft morning with song.

I can tell the rain has stopped. They are celebrating.

Birds are always doing amazing things.

How do they fly so fast and so high and then land on a small twig in one second?

How do they balance on a flower without hurting themselves or the flower?

Do they know that most berry plants in the world were planted by their grandparents?

There would be a lot more bugs in the world if they were not a top food item for many birds. (According to the Audubon society, one swallow can swallow 60 bugs -while flying!- in an hour or 850 a day. My grandmother said that I ate like a bird, which meant very little. She obviously had not heard



Watercolor paintings by Joyce Dutka

after a rain and saw a bird dive right into the water and stay under quite a while, I imagine looking for food. Then it leaped up into the sky and over the high waterfall, flying parallel to the water, upstream, keeping

about a foot above the water the whole time. This is a great and rare talent.

We tend to think birds eat berries and peck fruits in our gardens, so we put up netting and scarecrows and swinging pie tins. Imagine how many fewer quality fruits there would be if the birds were not keeping the insects at bay. The birds find them and eat the insects that are going after the flowers and fruit buds and young fruits. They are our partners in life and work.

Birds come to our gardens and orchards and perennial beds. They are comfortable here and find food and

shelter and feel safe. It feels like home. Every growing, flowering thing we plant or nurture becomes bird habitat.

There was some undeveloped land in the neighborhood where I grew up that was called "a bird sanctuary." I remember thinking this was a very good idea. All of us with a little land can make a place on which birds will feel at home. Letting them be. Not messing with the land too much. Asking ourselves, "What would a bird like?" How can we help the golden crowned kinglet and white breasted

nuthatch feel at home? Where will the goldfinch and the blue headed vireo, the hermit thrush and the ruffed grouse like to spend their nights and days? They like it at our farm right now, so we will work to ensure we

BIRDS

Maybe they are our ancestors, returned, to be around us and remind us of our path.

To be kind, good people. To grow good, healthy food. To walk lightly on the earth.

To plant seeds. Not to take too much and to share.

To remember to take things lightly.

To make sure to hear the song of the morning.

- David Fried

don't change things too much. As we plant more fruit trees and berries and flowering shrubs and encourage the native shrubs also, the word seems to get out that our place is where they want to be.

Stephen Wright the comedian says he was having breakfast and a bird came to



Painting by Joyce Dutka

his window sill, and he asked it how it was doing.

The bird said, "Summers here, winters there, whoever thought this up, certainly wasn't a bird!"

We can do our part to make their lives easier, and they will return the favor tenfold with their songs, colorful dances and natural insect patrol.

Birds are my heroes.

David Fried is a writer, grower and bird habitat enthusiast. ♻️



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Winter Composting 101

Cassandra Hemenway

As a compost educator in central Vermont, I've been surprised at how many people tell me that they stop composting over the winter. Although Northeasterners tend to be unfazed by freezing temperatures, even the hardiest may balk at that thirty-second walk outdoors to drop off the food scraps in January.

But there are a few simple steps that can make winter composting accessible and successful.

First let's acknowledge the challenges that can hinder winter composting for folks who are frail or challenged with mobility; it isn't an option for everyone. If that's you, consider dropping off your materials at a food-scrap drop-off site or finding a food-scrap curbside hauler through the winter months.

But for many of us, the real challenge to winter composting is in our heads. It's cold. There's snow. The food scraps freeze and don't immediately break down. We don't want to. All of that is legitimate but surmountable.

Getting food scraps out to the bin in the winter doesn't have to be an impossible chore; it can be part of your normal routine, and a little extra exercise. Make it fun; strap on snowshoes or cleats or use a sled. Make a snow angel on your way back to the house; use the outdoor time to check your bird feeders.

There's no biological activity happening once the temperature drops below freezing, and that's okay. You're not



Image: <http://halifax.mediacoop.ca/>

composting in winter, you're putting food scraps into frozen storage until spring, when they will break down. If you are "storing" food scraps

until they can truly compost in spring, then make sure you start with enough space so you don't end up with an overflowing mountain of frozen banana peels and carrot tops.

Follow these winter composting tips, and you'll get a jump start on next spring's compost and enjoy a little winter exercise while you are at it:

- Ideally, you have at least two bins to begin with, you receive "extra points" if you insulate your bins to extend the season.
- Make sure you have one empty bin ready by mid-November or no later than when the ground freezes.
- If you have two bins, empty the bin with the oldest 'resting' compost either directly onto your garden or into a storage bin to use in the spring.
- If you have a second active compost bin, turn it one last time before winter. This will aerate any materials you've been composting through spring and summer, and prepare them for resting over the winter. Once you've turned your formerly active pile, cover it with a layer of browns and let it rest until spring.

- Fill your empty bin over the winter. If it will help motivate you to keep composting all winter, move it to a convenient location away from snow plows and rooflines but closer to your door.
- Store browns (such as wood shavings or dried leaves) in a covered tote near your compost bin so you can continue to add two to three parts browns to one-part greens (food scraps). It's important to keep adding those browns all winter.
- If your active compost in is too far away from your doorstep for you to realistically go out there all winter, move it temporarily or use a short-term bin out of an old trash barrel and move the materials into your regular bin in the spring.
- Don't forget to shovel the path to your bin when it snows. This is one of those things that can make or break your willingness to keep up with winter composting, so add it to your list of winter exercise!

There are usually some winter days when it gets warmer than 32°F; when that happens the composting starts happening, and the pile shrinks a little. This process means it's rare that your bin will actually fill or overflow, as long as you start winter with it empty.

By spring, you'll be ready to turn your winter compost pile— it will probably be wet and a little anaerobic from sitting all winter. Just turn it over, add browns, and let it rest. Soon you'll have that rich black gold that your lawn and garden love.

Cassandra Hemenway is the Outreach Manager at the Central Vermont Solid Waste Management District (CVSWMD) as well as a former journalist and passionate gardener and composter. She leads workshops and webinars about composting, recycling, and managing toxic and hazardous materials. Learn more at the CVSWMD YouTube channel @zerowastecentralvts. ♻️

Human-scaled Transportation, Human-scaled Sanitation

Julia Cavicchi

The Rich Earth Institute is people-powered in more ways than one. Most of our staff members have been biking to our research center this summer. We are not the only ones biking more and driving less. The COVID-19 pandemic has sparked newfound enthusiasm across the country for biking as an alternative to driving in cars and riding on buses.

In Brattleboro, VT, as bike sales surged, so did urine collection. In the midst of the pandemic, many of our urine donors are staying home and collecting more pee than ever before. Through Rich Earth's community-scale urine nutrient collection program (the first in the nation), these dedicated urine donors will enable us to fertilize more hay on local farms next spring and contribute to cleaner downstream watersheds.

Bikes make it easy and affordable for people to reduce their dependence on carbon-heavy cars. Likewise, urine nutrient recycling can be an accessible pathway for gaining independence from wastewater nutrient pollution, and reclaiming interdependence with our watersheds. While initially designed to treat pathogens and reduce disease, our current wastewater systems pollute downstream water bodies with excess nitrogen, phosphorus, and pharmaceuticals, resulting in harmful algal blooms, mass fish kills, and damaged shellfish populations—not to

Cont'd on p.35

COMMUNITY GREENHOUSES SPROUTING

Jessie Haas

When Marilyn Chiarello, founder of Edible Brattleboro, saw a free hoop-house frame offered on a local listserv, she started dreaming. A place for the organization to start seedlings for its neighborhood 'help-yourself' gardens. Seedlings to share with the community. A place for people to start their own seeds, maybe



Edible Brattleboro volunteers grow food in public spaces, like the grassy area between the Brattleboro Food Coop parking lot and the Whetstone Brook Image: Edible Brattleboro.

with workshop days. A chance for other community members to get involved. But she needed to get that hoop-house, so she said, "yes" to the offer from Fertile Fields Farm in Westmoreland, NH and then persuaded her organization's board it was a good idea.

Edible Brattleboro started in 2015 after Chiarello, a former elementary school teacher and vegan chef, watched Pam Warhurst's TED Talk, "How We Can Eat Our Landscapes." For the past five years she and fellow volunteers have been growing food in public spaces, such as the grassy area between the Brattleboro Food Coop parking lot and the Whetstone Brook. Food is free to community members, who are invited to help themselves. Edible Brattleboro now has several gardens around the scenic Vermont town, and gives away produce on Sundays at its Share the Harvest stand. They also put on workshops on composting and gardening, and more recently, ran a canning workshop using tomatoes grown in the greenhouse at the Hilltop Montessori school, shut down

in the spring by the novel coronavirus. A hoop-house for plant starts seemed like a natural fit, and the board was persuaded.

But where to put it? After an initial offer fell through, Chiarello approached the new food hub at the Retreat Farm which had the perfect space next to the community garden along the West River. The location is less than a mile from the center of Brattleboro, with a sidewalk running most of the way. The Retreat Farm's own market garden and farm stand are also nearby. Some Americorps volunteers helped take down the hoop-house frame, the Rich Earth Institute transported it, and it now awaits permitting. The plan is to get the hoop-house put up this winter and start growing plants this spring.

In its proposal to the Retreat Farm, Edible Brattleboro indicated that a governance committee is expected to include representatives from the Retreat Farm, Edible Brattleboro, gardeners with plots in the community garden, and possibly members of the general public, will establish procedures for usage. Chiarello says, "The vision is to start seedlings in the spring to get a jump

on the season and possibly grow tomatoes as we did this year in the greenhouse at Hilltop Montessori." Their grant application includes a stipend for a greenhouse coordinator to make daily visits and make sure everything gets watered.

Meanwhile in Chester, VT, another ambitious community greenhouse project is underway, this one the brainchild of Robert Nied, who moved to Vermont from upstate New York three years ago to take a job. A lifelong northeast gardener, Nied found that having a greenhouse of his own extended his growing season and allowed him to grow produce he hadn't succeeded with in the past, such as eggplant.

A trip that took him by the community gardens made him wonder, "Why not a community greenhouse?" He shared the idea with fellow Chester residents Melody Reed and Cheryl Lipton on their weekly Zoom meeting called Victory Gardening in the 21st Century, and they liked the idea.

Then opportunity struck. Deconstruction Works of West Dummerston, VT, a company specializing in green demolition and recycling of houses, outbuildings, and interiors in Vermont, New Hampshire, and western Massachusetts, was taking down a 100 by 32-foot antique greenhouse in Walpole, NH. The building dated to the 1930s. Wreathmaker and florist Robert Woodward, having been flooded out of his Westminster, VT location twice in a decade, decided to move across the river to higher ground. The galvanized steel and iron frame was free for the taking, if the community garden organization could transport and house it. Chester selectboard chair Arne Jonyngas offered manpower, and vice chair Heather Chase provided temporary storage in her barn.

The next challenge is fundraising, and finding the ideal location. Creating a new foundation for the greenhouse is projected to cost \$150,000-\$175,000. Around three acres are required to provide space for outdoor plots as well as the greenhouse itself, and the organization hopes to acquire land near the center of town, with access to the public water supply. Some donations and



Volunteers from Edible Brattleboro and Americorps help to take down a hoop-house frame, hoping to set up the hoop-house at The Retreat Farm this winter and start growing plants this spring. Image: Ananda Brutvan.



Moving the greenhouse for eventual use. Courtesy image: Chester Community Greenhouse and Gardens.

grants have already come in, and more are being sought. The greenhouse will be ADA-compliant in at least one section, so gardeners with disabilities will be able to access the resource.

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Vermont.

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

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Human-scaled Transportation – Sanitation – Cont'd from p. 34



The whole Rich Earth team biked to work on a beautiful, foggy morning this fall. Courtesy photo.

are powered by the land and the land is powered by us!

How we move in the world changes how we relate to it—how we transport ourselves as well as what we do with our vital nutrients once they leave our bodies. Together, we can cumulate our power into collective action; whether reclaiming the streets through critical mass bike rides or reclaiming our bodily nutrients through community scale urine collec-

tion. Even as looming political crises seem beyond our control, simple, human-scaled actions can remind us that we can pee the change we want to see in the world.

With biking, we return to relations of reciprocity, breathing in the sharp scent of autumn leaves and breathing out a human amount of carbon dioxide to return to the trees. We find reciprocity in eating nutrients grown from the land and returning our nutrients to the soil that sustains us. In this way, our bikes

tion. Even as looming political crises seem beyond our control, simple, human-scaled actions can remind us that we can pee the change we want to see in the world.

Julia Cavicchi is the Director of Outreach & Engagement at Rich Earth Institute (richearthinstitute.org) where they are reclaiming bodily nutrients as a resource. ♻️

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American Council for an Energy-Efficient Economy: Consumer guide to home energy savings - aceee.org/consumer

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

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

Buildings Energy Data Book: buildingsdatabook.eren.doe.gov

Carbon Tax: carbontax.org

Clean Power Estimator: www.consumerenergycenter.org/renewables/estimator

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

Efficiency VT: This is a must-go-to site for immeasurable amounts of info. www.encyvt.com

Energy Efficiency & R/E Clearinghouse (EREC): eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html

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/tax_credits.

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

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Find Solar: www.findsolar.com

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

Greywater Info: www.oasisdesign.net/greywater

Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home.

A lot of great information! - hes.lbl.gov

Home Power Magazine: www.homepower.com

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

National Solar Institute: www.nationalsolarinstitute.com

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

New Hampshire Sustainable Energy Assoc. NHSEA Focused on N.E. US, for consumers & industry- RE & clean building info, events. www.nhsea.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 Office of Energy and Planning: www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.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 Living Source Book: realgoods.com/solar-living-sourcebook

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 Energy Grid: www.pvwatts.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

Track the Stimulus Money: www.recovery.gov/Pages/home.aspx

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.

Vermont Tar Sands Action: Group working to stop the XL Pipeline and any other developments stemming from the Alberta Tar Sands. To join this group go to: groups.google.com/group/vt-tar-sands-action

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

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NEW ENGLAND ON FIRE

Cont'd from p. 33

livelihood was farming, there were always 20 or 30 people in town." Now that people have to drive out of town to get to work, there's often not enough firefighters in town when the fire alarms go off.

So far, Cormier said that the Forest Service has been up to the challenge this summer. "We have some of the best people for fire-fighting in our incident command system," she said, adding that many have expertise gained from fighting fires out west. "It's just not knowing what's down the pipe—with climate conditions changing and people not able to help as much. That's what makes me nervous."

Philip Kiefer covers science and healthcare from New Orleans. He has written for National Geographic, Outside Magazine, Down East Magazine, and FiveThirtyEight.

This article was originally published in Sierra Magazine (sierraclub.org/sierra/new-england-also-fire) on Oct 11, 2020. ♻️

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End of the World

Cont'd from p.1

Nevertheless, there are other things we can do.

One thing we have not really started on is getting those who are in denial out of it. Some of those people will listen when they understand that all is not doom and gloom. That is especially true for people who are worried that dealing with climate change will be expensive and reduce our standard of living. That is not the case, according to a very recent report from a financial major.

At about the same time the Scientific Reports came out, PricewaterhouseCoopers (PwC) published "2022 The growth opportunity of the century" (<https://bit.ly/PwC-opportunity>). PwC is the second largest professional services network in the world and the fifth largest privately owned company in the United States, according to its Wikipedia entry (<https://bit.ly/WP-pwc-entry>). PwC is advising its clients to be prepared for a global shift in investing that will, by 2022, see 77% of institutional investors worldwide stop buying products unless they operate according to environmental, social, and corporate Governance (ESG).

We might consider the PwC article from the point of view of the world as we know it changing. It says that in the very near future nearly all businesses will be pushed hard by their investors to achieve environmental and social sustainability, and a large number of them will adopt ESG. That will mean a change in the marketplace, which will

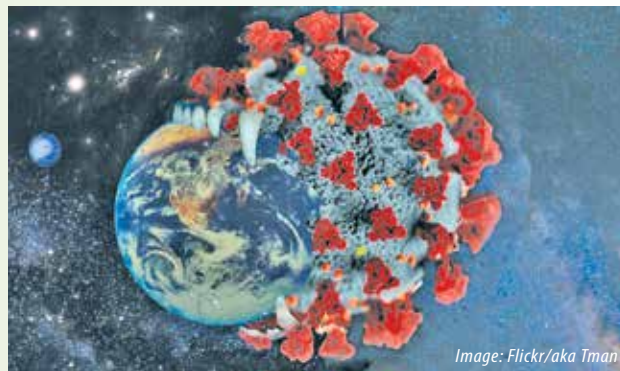


Image: Flickr/aka Tman



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have ramifications for energy industries.

Truthfully, it is clear that we cannot escape environmental changes. We already have a few of them. We already have everything from wildfires and hurricanes to such invasive species as Lyme ticks. The changes we see arise out of environmental changes we have caused unintentionally.

What we need is wise and intentional change. And though we are just setting up what to do, we have good ideas about what to do. We really do have hope.

Some things are harder than oth-

ers. We can bet that hurricanes will continue to get worse. That will happen as long as there is excessive CO2 in the air, and it will take at least decades to address that fact. But hurricanes are not the only problems we have with climate change. And some of the others can be addressed effectively. I will give two examples.

One method for dealing with drought, developed in Australia, is natural sequence farming (<https://bit.ly/natural-sequence>). By slowing down the water moving across the land, restoring that motion to what it had been before it was farmed, the water table is raised. This means crops grow better with less irrigation. It also means wildfires have less chance to spread. If much of California were engineered with what are really minor changes on the principles of natural

sequence farming, it could have profound effects on the state and on the climate.

Another tool we have is high tech. In 2017, as wildfires raged in Northern California, Stone Edge Farm was spared, because it had its own solar-powered microgrid, which could be controlled through the internet and powered its irrigation system after workers had evacuated. This was covered by an article in CleanTechnica (<https://bit.ly/CT-Stone-Edge>). With the

lucky circumstance that the internet connection was not destroyed, the farm was saved by maintaining heavy irrigation.

We may not be able to stop hurricanes and methane emissions from the tundra, so we need to draw down carbon from the atmosphere. But we can engineer the environment to help with floods, drought, and wildfires.

I have no doubt at all that there will be change. It may come to destroy us if we stay in denial. It will come to make the world a better place, if we act wisely. ♻️



The world is changing. This was the Chacaltay ski resort in Bolivia. It depended on the snow of a glacier that has melted entirely. Image: Mauriki, Wikimedia Commons. CC-BY-SA 3.0 (<https://bit.ly/3fqmQxe>)



Larry Plesent

Ingredient of the Month For the Love of Foam

I love foam. I like it on my skin, in my coffee and on top of my beer. Foam is both fun and cool. Not everyone knows or cares that the bubbles in foam always have an odd number of sides in the presence of gravity. Or that despite being 95% gas, a glob of foam continues to act like a springy solid. Or that increasing the liquid-to-gas ratio results in flattened bubbles that might just mimic the true shape of our entire universe!

People like to see large, quick bubbles from their soap. It lets them know the soap is working. However, it is small dense bubbles which are perceived as creating a "rich" and "luxurious" foam. Formulating for a mix of quick large bubbles, small dense bubbles, and medium-sized "filler" bubbles is just one of the many factors to consider when creating natural products.

Enter the foaming dispenser cap. Invented in the Netherlands about 20 years ago, the foamer cap was brought to the U.S. just about 18



Dispensing foam. Image: Wikipedia

years ago. Factoid: The first liquid placed into a foamer for demonstration purposes in the USA was made by Vermont Soap. Years later Vermont Soap created the first USDA organic foam soap. More recently, we released the first 95% USDA organic foam soap (which can bear the USDA organic logo).

Foamer caps pump liquid soap or detergent through a series of screens to aerate it, resulting in a rich, full and creamy mass of shaving-cream-like bubbles delivered into the palm of your hand. No agitation required. Viscosity

must be adjusted to fit the tool, but the principle is straight forward. Air + water + surfactant = foam. Adding sugars and oils can alter the physical results to create longer-lasting bubbles or a milder skin feel (softer foams).

Early foamer caps seemed to last forever. But over time engineers learned how to cheapen the valves on inexpensive, stand-alone foamers that let air return to the cap and raise the piston for its next use. This built in obsolescence of the pump mechanism reduces the average number of "doses" per unit before the pump fails. While it might be good for the shareholders, this is

certainly a less than ideal situation for the planet and for those wishing to refill their foamer pumps! Keep this in mind when purchasing budget (and sometimes not so budget) foamer caps.

Raise your latte, beer or soap in a moment of appreciation for the humble foam! And have an awesome today!

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

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The Environmental Impact of Single-use PPE

We are throwing away huge amounts of single-use waste in responding to the COVID-19 crisis

Roddy Scheer and Doug Moss, EarthTalk®

There's no question about it: all the disposable personal protective equipment (PPE) in our waste stream is taking a toll on the environment. A recent study in the journal Environmental Science & Technology found that we are using some 129 billion disposable masks and 65 billion disposable gloves every month around the world as we try to stay safe in the midst of the worst pandemic to hit the human race in a century.

Most of the masks in the U.S. are made out of polypropylene-based plastic but some are made from related forms of plastic such as polystyrene, polycarbonate, polyethylene or polyester. These synthetic fibers are designed to resist liquids and do not biodegrade in the environment, instead breaking down into smaller and smaller pieces of plastic that end up in landfills or, even worse, as litter that finds its way into waterways and the ocean.

Some of the discarded PPE ends up in medical waste bins and is shipped off to an incinerator for disposal, which unfortunately may not be any better for our health or the environment. According to the U.S. Environmental Protection Agency (EPA), incinerators send particulate matter, heavy metals, acid gases, nitrogen oxides, carbon monoxide and other noxious pollutants airborne. Environmental advocates aren't happy about a plan by the United Nations to help communities around the world set up their own local incinerators to deal with PPE and other COVID-related waste.



PPE waste is a big environmental concern now, given we are discarding hundreds of billions of disposable masks and gloves every month globally. (Kaspars Misins, Pexels).

Meanwhile, reusable masks may have a longer useful life, but that doesn't necessarily mean they'll biodegrade in the environment when their time comes. Most are made from cheap synthetic fabrics like nylon or polyester and are prone to breakage and short lifespans, and can last even longer and wreak more havoc when littered into the environment.

The upshot of all this is that we'll have discarded PPE from the pandemic around for a lot longer than we would like. It joins the plastic that sits in landfills, washes up on beaches and floats in oceans, amounting to more than five trillion plastic particles contaminating the world's surface waters. The particles are toxic to ecosystems and wildlife. Marine creatures can mistake mask remnants and fibers for food, and/or can get entangled in them so they can't hunt, feed or eat.

What can we do to offset, or even halt the impact? The pandemic continues, but by choosing reusable, biodegradable masks, we can reduce the demand and consumption of PPE. Eco-friendly alternatives are available—or you can make your own using salvaged fabric and online craft guides. The Hemp Foundation and Tentree sell masks made from biodegradable and repurposed materials. Meanwhile, Bambooo's bamboo masks are made out of sustainably sourced, pesticide-free bamboo, and Planet Organics' cotton/rubber varieties are also attractive and easy on the environment.

Links:

- "COVID-19 Pandemic Repercussions on the Use and Management of Plastics," <https://bit.ly/3kyXsWR>;
- "COVID-19: Unmasking the Environmental Impact," <https://bit.ly/3kzVI59>;
- "Health experts call for reusable PPE to protect people and planet," <https://bit.ly/3nvGzOJ>;
- Hemp Foundation, hempfoundation.net;
- Tentree, tentree.com;

Planet Organic, planetorganic.com, Bambooo, Bambooo.com.

EarthTalk® is produced by Roddy Scheer and Doug Moss for the nonprofit EarthTalk. <https://emagazine.com> or <https://earthtalk.org>. Contact: question@earthtalk.org.

Discarded Disposable Masks and Gloves are Floating into the World's Waterways

From NBC News for the Coronavirus Update, Oct. 28, 2020



As the coronavirus pandemic continues, it's important to remember to throw away used personal protective equipment properly as more items wash ashore on beaches across the world.

During the annual International Coastal Cleanup last month, more than 62,000 items, including single-use masks and gloves, were collected. The amount of waste warranted a new category in the event's 35-year history, and experts say it's threatening the world's oceans and marine life.

Across the world, the scientific journal Environmental Science and Technology estimates that during the pandemic, one-hundred and twenty-nine billion disposable face masks and sixty-five million single-use gloves are being used every month.

The World Economic Forum has predicted that, in terms of weight, there will be more plastic than fish in the world's oceans by 2050. ♻️



Gary Stokes, Operations Manager at OceansAsia holds face masks found on a beach in Hong Kong. (Images courtesy of OceansAsia.org).

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RESULTING IMPACTS OF A PANDEMIC ON THE WASTE STREAM

Marc Morgan

The Coronavirus (Covid-19) seems to have had an impact on every aspect of our lives. No more movies. No more hockey games. School is taught via Zoom. Dining alfresco is now the norm. Covid-19 has even had effects on the way we generate and throw away our trash and recycle.

When this virus first hit in the U.S., many local transfer stations and recycling centers reduced hours, changed their acceptance policies and even limited the number of people on site. Many waste facilities moved to cashless transactions, some stopped charging, some closed their facility buildings to non-employees and a small number of facilities stopped recycling all together.

These changes are only the surface. There have been a number of other changes to



Above: Mattresses at Lebanon Solid Waste Facility Lebanon, NH. Left: Couch and mattresses in the dumpster. Courtesy images: Evelyn R. Swett (evelynrswett.com).



waste produced. Processing costs for recycling have gone up with increased labor needs, safety protocols and main-

the way waste and recycling are managed since a pandemic was declared in the spring of 2020.

As an individual, you are seeing more single-use plastic. This rapid change is to protect public health. For a brief time, reusable bags couldn't be used in NH. Some stores continue to prohibit the use of reusable bags, while others ask shoppers to bag their own purchases. Single-use coffee cups are back on the rise; due to a concern for reusing travel mugs. Navigating some of these changes can be difficult. To reduce confusion, do your homework and check on your frequently used shops. You should also consider making coffee at home; packing a lunch from home and bringing water from home in a reusable container. You can still reduce waste with a little planning. For those who want to use their reusable shopping bags or mugs, call ahead to see if and how you can use one.

The pandemic has affected our work lives by encouraging people to work from home, where possible. Working from home not only reduces commuting time and transportation-energy use but also generates less waste. Employees use more digital resources (emails, notes, and file sharing) while working from home. This equates to less waste. Also, when working from home, people likely make their lunch as opposed to consuming packaged meals; again, producing less waste.

Nationally, Covid-19 has impacted larger solid waste and recycling programs as well. Solid waste disposal rates are down nearly 15%. With so many businesses closed, there is actually less

maintaining social distances.

However, curbside recycling collection is up due to remote working. Many are also shopping more online, so the amount of cardboard generated is also up. The downside is that overseas recycling markets are in a bit of a slump, so many large recycling facilities have a backlog of recyclables stored. To help with a backlog of recyclables, domestic recycling capacity is being planned and should be operational within the next 18 months. This should help to ensure future options for all of our recyclables. Many domestic markets are commanding very clean material due to the increased supply of recyclables, so be sure when you recycle your bottles, cans, paper and cardboard that it is done

correctly to ensure recyclability.

With the increased unemployment rate, many of us found ourselves at home with nothing to do. This situation resulted in an increase in clean-out projects. Homeowners have been cleaning out basements, garages and barns. At one local solid-waste facility, the number of old couches and mattresses delivered for disposal nearly doubled. Based on informally talking with local waste haulers, cleanout job requests

are up nearly 200%. If you are cleaning out your home, be sure you know what charges to expect and how a particular waste can be processed.

Last, don't be discouraged. Find a reusable face mask, stay six feet apart and do your part to reduce our waste's impact on the environment. Be sure that when you are recycling, you do it right. Reach out to your local recycler to find out how they are handling the current challenges, and what items are truly recyclable.

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. ♻️

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