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The Global Economy Crumbles

Dr. Alan K. Betts

The collapse of the global capitalist economy in the face of the COVID-19 pandemic has valuable lessons for us. Capitalism searches for places, people and resources that can be exploited to maximize profit and minimize costs. Capitalism has no moral guiding principles, it simply demands growth and profits, with no consideration for resilience and long-term stability. Historically justice for working people was not considered, let alone justice for life on Earth.

Looking back, it is clear that the growth of the capitalist system was powered by fossil fuel. The post-WWII boom in the U.S. was possible because we controlled the global oil supply, and froze the price of oil at $3 a barrel, until first OPEC rebelled in 1973, and then Iran in 1979. This led to financial shocks in the 1980s. At the same time the rapid burning of fossil fuels that had safely resided underground increased the atmospheric greenhouse gases, which reduce the cooling of the Earth to space. As the planet warms, more than 90% of this energy imbalance is being stored in the oceans, driving stronger storms and climate change that is accelerating. This threatens not just humanity – especially our children and grandchildren - but it is also driving the extinction of millions of species. Capitalism as it has functioned is both immoral and incompatible with a livable Earth.

But since "free-market" capitalism has externalized all its adverse impacts, it does not pay for the current oppression of people, nor for the future catastrophic long-term costs of climate change. This is clearly cruel and stupid, but it continues because it is so profitable, and a trillion dollars in profit can bribe a lot of politicians, and buy a lot of media time to deceive the public.

The COVID-19 pandemic exposes a second stupidity of a capitalism that exploits without considering resilience. In the past two decades, in the search to maximize profit, a lot of manufacturing was outsourced first to China and then other Asian countries. Now

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Adobe stock image 64649096

COVID-Safe and Sustainable Summer Activities: Good for You and the Environment

N.R. Mallery

"Social distancing" is actually quite easy while we're outdoors, but we should not let our guards down. COVID-19 is still here, still active and waiting to infect unsuspecting victims.

But at this time, let's also not forget about the environment. Beyond the pandemic lies our climate emergency, an even worse challenge facing us, not only this summer but for many years to come.

That said, let's look at just a few of the possibilities for outdoor activities we can safely participate in this summer and enjoy our environment during the pandemic:

The 146.16-kW solar system (background) at Laurel Lanes is a net-zero project that wipes out their entire electric bill. Photo: Joseph Videtta.

Golf: Golfing is among one of the first public sporting activities to open during our challenging 2020 summer season. Some regional golf courses are also taking the environment and climate seriously. Read about how golfing is becoming more sustainable in the northeast on p.21, Sustainability in Golf.

Biking and e-biking: There are more people biking during the pandemic for exercise to do errands and for a safe means of transportation to work. Sales for e-bikes are soaring, because they make it easy to get around on our hilly terrain. Read more about e-bikes in our region on p.4. and see the new start-up business, Hanover Adventure Tours ad on p.4 that rents e-bikes with touring maps and more.

Water sports: Kayaking, stand-up boarding, one-person or limited passenger sail boating, sculling, canoeing, and row boating can all be done with social distancing.

Tennis: Many outdoor tennis courts are now open to the public, but clubhouses, changing-rooms, and restrooms may possibly be closed. It is recommended that you play singles against one person from another household. For doubles, it is safest if everyone is from the same household.

Walk in the woods: Hiking is encouraged for healthy activity but caution needs to be considered to prevent an upsurge of the Covid-19 virus in our region.

North Conway, NH is one example of a destination for backcountry hiking because of the lure of the White Mountain

Cont'd on p.20

Job Creation for Millions Under the Green New Deal

Roger H. Bezdek

Millions of green jobs will be created under the Green New Deal. Image from Green for All.

The Green New Deal (GND) refers to proposals designed to address climate change, economic inequality, and other issues. The name derives from the New Deal, and the concept of the GND combines President Franklin Roosevelt's program with contemporary plans involving environmental programs, renewable energy, and energy efficiency.

The GND is controversial. Democrats advocate it as a much needed economic and job stimulus and as a way to facilitate recovery from the current environment where job losses and unemployment are at record levels not seen since the Great Depression. Republicans contend that the GND would ruin the economy and destroy jobs. And there are many other views from people not connected with the two major political parties.

The GND is not well

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

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

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

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

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THE SUN DAY CAMPAIGN NEWS

RENEWABLE ENERGY PROVIDES ALL NEW U.S. GENERATING CAPACITY

Washington DC – According to a review by the SUN DAY Campaign of data just released by the Federal Energy Regulatory Commission (FERC), wind, solar, and hydropower provided 100% of the 1,328 megawatts (MW) in new U.S. electrical generating capacity added in April 2020.

Smoky Hills wind farm, Kansas. Drenaline, Wikimedia Commons, https://bit.ly/2NcS65zDrenaline

FERC's latest monthly "Energy Infrastructure Update" report (with data through April 30, 2020) also reveals that renewable energy sources (i.e., biomass, geothermal, hydropower, solar, wind) have accounted for 5,113 MW - or 56.3% - of the 9,082 MW added during the first four months of this year. Thirty-two new "units" of wind (totaling 3,104 MW) were added to the U.S.'s total energy generating capacity accompanied by 110 units of solar (1,973 MW), six units of hydropower (25 MW), and two units of biomass (11 MW).

FERC also reported 3,964 MW (or 21 units) of new natural gas capacity, which accounted for most of the balance. There have been no new capacity additions by coal, oil, nuclear power, or geothermal energy since the beginning of the year.

Renewable energy sources now account for 22.87% of the nation's total available installed generating capacity and continue to expand their lead over coal (20.32%) [1]. The generating capacity of just wind and solar is now at 12.87% of the nation's total and that does not include distributed (e.g., rooftop) solar [2].

For perspective, five years ago, FERC reported that total installed renewable energy generating capacity was 17.05% of the nation's total with wind at 5.74% (now 9.08%) and solar at 1.05% (now 3.79%). Thus, over the past half-decade, wind's share of the nation's generating capacity has nearly doubled while that of solar is now almost four times greater.

By comparison, in April 2015, coal's share was 27.50% (now 20.32%), nuclear was 9.14% (now 8.71%), and oil was 3.92% (now 3.29%). Only natural gas has shown any growth among non-renewable sources - expanding from a 42.23% share five years ago to 44.64% today.

In addition, FERC data suggest that renewables' share of generating capacity should increase significantly over the next three years (i.e., by April 2023). "High probability" generation capacity additions for wind, minus anticipated retirements, reflect a projected net increase of 26,867 MW while solar is foreseen growing by 24,083 MW. By comparison, net growth for natural gas will be only 20,657 MW. Thus, wind and solar are on track to each provide more new generating capacity than natural gas over the next three years.

While hydropower, geothermal, and biomass also are all projected to experience net growth (1,903 MW, 178 MW, and 19 MW respectively), the generating capacity of coal and oil are projected to plummet - by 16,428 MW and 3,112 MW respectively. In fact, FERC reports no new coal capacity in the pipeline over the next three years and just 4 MW of new oil-based capacity. Nuclear power is forecast to remain essentially unchanged - adding just 2 MW.

In total, the mix of all renewables will add more than 53 gigawatts (GW) of net new generating capacity to the nation's total by April 2023. That is nearly 50 times the net new capacity (1.1 GW) projected to be added by natural gas, coal, oil, and nuclear power combined.

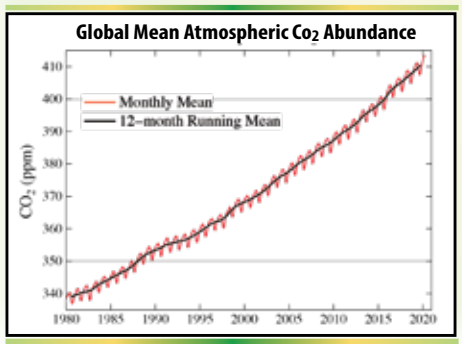
If these numbers hold, over the next three years, renewable energy generating capacity should account for more than a quarter of the nation's total available installed generating capacity.

In fact, renewables' share could be even higher. Over the past year, FERC has been regularly increasing its renewable energy projections in its monthly "Infrastructure" reports. For example, two months ago in its February report, FERC forecasted net growth over the next three years of 50,933 MW for renewable energy sources (i.e., 2,117 MW less than its latest projection).

"Notwithstanding the impacts of the global coronavirus crisis, renewables - especially wind and solar - are continuing on their march to eventual energy dominance," noted Ken Bossong, Executive Director of the SUN DAY Campaign. "And as prices for renewably-generated electricity fall ever-lower, that growth trend seems certain to accelerate."

Notes and Sources for this article will be available online at the Green Energy Times *website, greenenergytimes.org.*

The SUN DAY Campaign is a non-profit research and educational organization founded in 1992 to support a transition to 100% reliance on sustainable energy technologies as a cost-effective alternative to nuclear power and fossil fuels, and as a solution to climate change. Contact: Ken Bossong, 301-588-4741 or 301-270-6477 x.6 ♻



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417.16
parts per million (ppm)
June 12, 2020

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Supporting a Vermont Global Warming Solutions Act

Sandra Levine

As Vermont's legislators are buckling down to provide relief for struggling communities, they are also looking ahead to build a healthier, safer and more resilient Vermont for everyone. Seizing opportunities now will make communities stronger and avoid future damage and suffering.

Setting a model for other states, the Vermont Legislature continues to operate safely and remotely. With virtual meetings, they quickly secured hazard pay, as well as relief from evictions, foreclosures and utility shut offs. Legislators are now also looking to rebuild in ways that help Vermonters thrive and face the challenges ahead.

2020 Climate Solutions Caucus. Courtesy photo.

A key building block for the future is enacting the Vermont Global Warming Solutions Act. The bill passed with an overwhelming majority in the House before the pandemic hit. It is now being considered by the Senate. The bill turns the State's goals to reduce harmful climate pollution into clear requirements and makes sure that the actions we take benefit everyone.

The brutal COVID-19 pandemic has unmasked the outsized impact of its toll on poor, minority, and marginalized communities. Rates of serious infection and death are most severe in areas already hard hit by pollution where higher rates of asthma, heart and lung disease make COVID-19 deadlier. These same communities face outsized impacts from climate change.

By passing the Global Warming Solutions Act now, Vermont can rebuild in ways that reduce pollution, lower energy bills, and support good paying jobs that build a safer and more secure future for everyone. The Vermont Global Warming Solutions Act would put the state on a path to slash polluting emissions while making sure rural communities and hard-working Vermonters prosper.

Stop Emissions from Rising in Vermont

Despite past efforts, Vermont's greenhouse gas emissions have increased in recent years. The Vermont Global Warming Solutions Act would reverse this troubling trend. It creates a Vermont Climate Council to recommend actions that achieve the needed reductions by 2050 with clear benchmarks along the way. The bill also requires the state to put in place regulations to ensure success. No more missing targets or wishing we had done better. Vermont will see progress and know it is on track each step of the way.

Help Low-Income and Rural Communities Prepare for Climate Change

The bill is not just about regulations to slash emissions. It also kickstarts action to help vulnerable communities stay resilient in the face of climate impacts. With this bill, Vermont's rural areas will be better prepared for the next, inevitable storm. It also makes sure that Vermonters with lower incomes, and those hit hardest by the costs of climate change, will have better access to clean energy, clean transportation, and lower heating and housing costs. Growing jobs and saving money makes this a win for everyone.

The bill also promotes the use of natural systems and working lands to capture and store carbon to better protect Vermont against severe storms and floods. Trees, soil, wetlands, and shorelines have valuable natural features that bolster resilience and keep carbon out of the atmosphere, keep water clean and flowing within river banks, and keep farmland fertile. Supporting and protecting these natural systems saves money and keeps Vermonters healthier and safe.

Provide Far Reaching Benefits

A Vermont Global Warming Solutions Act will guide state action to cut emissions, encourage investments in clean energy and community resilience, and modernize roads, and wastewater and energy facilities. Families can have new opportunities to drive cleaner electric vehicles or drive less and have more money available for other needs. Weatherizing Vermont's oldest homes makes them safer, healthier, and more comfortable. And using more renewable electricity will keep lights on and businesses successful for the next decade and beyond.

Our reliance on dirty fossil fuels wrecks our air, our climate, our health, and our future. We can do better. The Vermont Global Warming Solutions Act makes sure we do. Taking definitive action on climate action goes a long way towards cutting pollution and keeping more money in Vermonter's wallets.

Vermont's legislature now has the opportunity for bold action to come out of the COVID-19 pandemic stronger and secure a better future for all Vermonters. Action now in the Vermont Senate will make sure Vermont sets a course for a safer, healthier, more resilient destination.

Sandra Levine is a Senior Attorney with Conservation Law Foundation in Montpelier, Vermont www.clf.org. ♻

A GREEN NEW MARKET

George Harvey

A Green New Market is coming. We can create it, or we can watch other countries create it. But it is coming, and it should be in America.

The Green New Market should appeal to Democrats because it can address poverty, the environment, and climate change. I want to point out, however, that Democrats seem not to mind much that wealthy people are wealthy, as long as the needs of poor people and the environment are addressed.

Republicans, similarly, would not mind doing things to address poverty and climate change as long as it means that people can be free to attain and keep exceptionally high levels of wealth.

Our response to the coronavirus pandemic shows clearly that conservatives and liberals can work together. The economy has been hit badly, putting poor people out of work and making stock market value vanish. I would never have expected Democrats to be willing to back a solution to fix the market economy by throwing money at it, just as I would not have expected Republicans to be willing to throw money at people in need. But that is what they did, and they did it together. Trillions of dollars are being thrown at the economic problem caused by the coronavirus.

I suggest that Americans should do better than throw money around. I believe we can do more, and do it better, if we create our own Green New Market.

I will start by suggesting that Republicans do something they will find entirely counter-intuitive, until they look at the bottom line. They should get behind the Green New Deal. And they should back it, not just locally, but worldwide. Why should Republicans do that? Because they can make nearly unimaginable piles of money by doing so, and they can make America great again in the process.

Off-grid power. Photo: USAID in Africa. Public domain.

I want conservatives to consider an image. Suppose we put aside just 10% of the initial response money many of them were willing to throw at dealing with economic losses caused by the coronavirus pandemic. Out of the $2.2 trillion in that initial response, we would be using just $220 billion.

Now suppose we spent all of that money here in the United States, employing people to build small solar kits for people who now have no access to electricity. Each kit is to cost $1,000. Each would have one or two solar panels, a small inverter, a small charge controller, a battery, a cell-phone charger, and LED lights. Now, we take the 220 million kits we have made and give them away to people, all over the world, where access to power is not available. That would power the households of something like a billion people.

These families include about a billion people who are not currently customers for American products. With electric power, however, they

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Clean Transportation in the Time of COVID-19

David Roberts

The arrival of COVID-19 across the world has led to massive reductions in vehicle use due to travel restrictions enacted to minimize the spread of the virus. In the midst of the current upheaval, many individuals have discovered opportunities to rediscover their local communities. Municipalities have taken unprecedented steps to close off streets to through traffic to allow more space for physically distant walking and bicycling, and, in many cases these streetscape improvements are likely to stick around even as travel restrictions ease.

Many scientific studies have examined the potential health impacts of air pollution prior to the onset of COVID and seen increased asthma rates and additional serious health issues in more polluted areas. The advent of COVID has highlighted the need to better address these community health and environmental justice issues because individuals suffering from compromised lung capacity or other maladies appear to have significantly higher mortality risk if they contract COVID-19.

The recent reductions in vehicle use have contributed to clearer, less polluted skies above many of our urban centers – a powerful demonstration of the potential benefits of weaning ourselves off fossil fuel powered transportation. A question on many policymakers' minds is what will happen as travel restrictions are loosened and more effective treatment and prevention of COVID becomes available?

Media coverage across the country has offered many perspectives on what our new normal for transportation systems might look like, including higher rates of telecommuting, improved infrastructure to support walking and bicycling, opportunities to accelerate adoption of plug-in electric vehicles (EVs), and more. Many environmental advocates are pushing for "green stimulus" programs that may include infrastructure and market development activities to support clean transportation. These programs could help get laid off workers back on the job and contribute to our future well-being. In late May, over 80 environmental organizations issued a letter to Congressional leaders calling for stimulus programs that would accelerate clean transportation manufacturing, invest in EV charging infrastructure, deploy electric buses, and make EVs more affordable for consumers and businesses. Similar conversations are also happening closer to home as state legislatures grapple with their COVID responses.

COVID shared street signage from the City of Burlington, Vermont.

On the EV front, many automakers have at least partially restarted their production facilities, but it may take months for their supply chains to fully tool up. A few manufacturers have announced changes to some of their EV product plans as a result of these issues. GM has said they are delaying the launch of a significant update to their Bolt all-electric vehicle as well as a new "electric utility vehicle" that were supposed to arrive in late 2020. Ford has canceled a project with Rivian to develop a Lincoln SUV (although other Ford-Rivian products may still be on the way) and a minor delay to the launch of the Mustang Mach-E coming later this year or early next. Other EV manufacturers are undoubtedly facing similar operational challenges that may require additional time or investments to fully resolve.

Stimulus support could help automakers transition more of their production to EVs while additional incentives or other programs to reduce upfront EV purchase costs will help increase consumer purchase consideration. Support for EV fast charging infrastructure would also help address another critical barrier impacting EV adoption.

Stimulus support to electrify public transportation vehicles, including transit and school buses, would similarly boost bus manufacturers and provide long term benefits to reduce vehicle operating costs and improve their environmental performance. Many public transportation providers are reconfiguring seating, fare collection (or fare-free operations), or other aspects of their services to reduce COVID risks for their riders and staff but may require significant operating support to fill in budget gaps brought about by COVID-related issues and accelerate investments in greening their fleets.

Cleaning up our transportation system will benefit our families and future generations, but challenges persist, including the current oil glut driving down gasoline prices and giving some drivers less motivation to consider other options. You can help by making greener, healthier choices for your household and lending your perspective to local, state and federal deliberations as policymakers grapple with COVID-related transportation challenges and opportunities.

David Roberts is the Drive Electric Vermont coordinator. He has driven all-electric vehicles for the past 7 years and says if you have to drive, drive electric. ♻

The E-bike Solution for Today and Going Forward

Staff article

There is a new business in Norwich, Vermont, Hanover Adventure Tours (HAT), with a focus on e-bikes for sale, rental, and tours. Robert Chambers is the owner and founder of HAT. The general manager is Chip Homeier, and Jayne Trailer is the sales manager, along with a full team of enthusiasts that are part of this exciting new business in town.

Long-time Norwich resident Susan Welch bought a new electric-assisted (e-bike) from HAT in June 2020 and is enjoying it immensely.

COVID-safe e-biking at Hanover Adventure Tours. Courtesy image.

Welch has been a cyclist for years, but now, at age 71, she is looking for a little help to stick with her passion for longer road biking trips.

"In my early thirties, I did a lot of bike trips like week-long ones to Maine and the Adirondacks. And so, now that I'm older and I don't have that endurance anymore, I was thinking that this would get me back into it and do some more biking [and] camping trips," said Welch.

Another local bicycle enthusiast, Karen Wynkoop from East Thetford, VT, wanted something less taxing to bicycle with after years of cycling. She told the folks at HAT, "I've always had a bike, and I bike sporadically. Now I want the will and the power to go up and down hills."

"I wanted an e-bike, and I met Jayne Trailer, and I finally got one. I ended up with the Magnum Navigator, and it's wonderful! I've been really having a great time with it."

Her bike not only has electric assistance when she pedals, it also has a throttle that provides power like that of a moped with the touch of her thumb. That appealed to Wynkoop. She explained, "There's a lot of hills around here, but that's the thing about this e-bike – it's not a problem. You can work as hard as you want, or you can just go for a free ride."

Wynkoop did mention that with a 48-volt battery, the bike has a range of up to 60 miles with some pedaling and can easily exceed 30 miles using the throttle.

HAT stocks a wide variety of e-bikes ranging from high-end Yamaha mountain bikes, "gravel grinders," and road bikes to more conventional commuter- type bike of the Magnum line. They even have the Payload brand, a bike suitable for carrying cargo as well as commuting.

Welch's new acquisition, like Wynkoop's, was the Magnum Navigator. The bike cost about $2,500, but with Green Mountain Power's $300 credit towards the purchase of any e-bike in Vermont, the purchase fell into a

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SMART COMMUTING IN NH & VT

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

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

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

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

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

IN NEW HAMPSHIRE

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

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

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

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

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

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

CONTOOCOOK VALLEY TRANSPORTATION (CVTC) - Monadnock Rideshare for the southwest region 877-428-2882 **cvtc-nh.org**

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

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

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

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

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

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

IN VERMONT

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

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

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

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

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

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

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

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

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

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

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

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

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

Local Energy $olutions

Driving Off and Plugging In: Less Gasoline, More Money

Carl Martland

In December 2014, my wife and I took our station wagon into the dealer to have snow tires put on. An hour or two later, we walked out as the unexpected owners of a plug-in electric hatchback. How did that happen? We actually were in the market for a new car, but, like so many in the North Country, we were thinking of buying an SUV well capable of dealing with icy roads. Still, we had an hour to kill, so we walked around the lot looking at other possibilities. On this cold, blustery early winter day, a salesman earned his fee by not even bothering to put on his coat before coming out to see if he could be of any help. We told him "Yes, we'd like another wagon just like the one that's being serviced," knowing full well this model had been discontinued. He replied, "Well, if you're interested in storage space, you should consider this car," pointing to an electric plug-in hatchback. That was news to us, as was the fact that the list price had just been slashed by $10,000. After figuring in the tax credits, this car would actually just cost us about $27,000, which, in real terms, was the same cost as the vehicle it would be replacing. A test drive demonstrated that that it handled like any other car, and it looked as good as any car we had ever owned. We had long been interested in electric vehicles, and we had never dithered when it came to buying a car, so we ended up buying an electric plug-in.

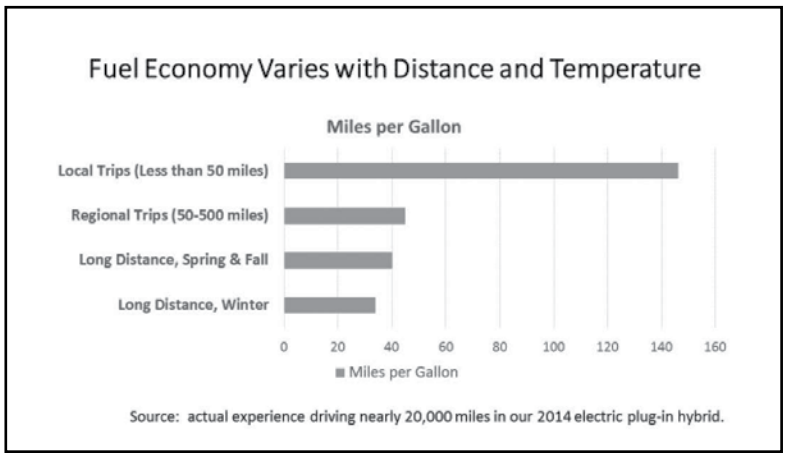
The car always gets its power from an electric motor. When fully charged, the car will go an average of 38 miles on the battery; the range can exceed 45 miles on warm days and drop below 25 miles on the coldest winter days. We plug the car into an ordinary home outlet at the end of the day, and it is fully charged by the next morning. If we aren't making any long trips, we can go months without buying gas.

Using electrical energy that costs about 18 cents per kilowatt-hour is much cheaper than using gasoline that can cost about $3 per gallon. At an average of nearly four miles per kwh, our fuel cost is less than five cents per mile for local trips. For a car that averages 25 mpg for local trips, the fuel cost would more than double to twelve cents per mile.

When the battery's charge is depleted, the car uses gasoline to run the generator that provides current to the electric motor. If the tank is full, you can go another 300 miles before you start looking for a gas station. On the highway, we have had no trouble keeping up with other cars, accelerating into traffic, or passing the trucks that line the interstates. We have Sirius XM, stereo sound, convenient cup holders, adjustable seats, and plenty of space in the back – we suffer no penalty in comfort, convenience or aesthetics by driving a plug-in.

Once the battery is depleted, we average about 40 mpg, whereas we used to average less than 30 mpg on long roads trips in our wagon. At $3 per gallon, we save about two cents per mile when operating as a hybrid.

Over the course of a year, cost savings will depend upon how many miles are driven in electric mode and how many are driven in hybrid mode. For our travel patterns, our cost savings have averaged just under four cents per mile. We have saved $750 per year by reducing gasoline consumption, which was offset by about $270 per year in electricity costs, for a net savings of $480 per year or $40 per month.



Source: actual experience driving nearly 20,000 miles in our 2014 electric plug-in hybrid.

Today, five years and 70,000 miles after our unexpected purchase, we still love our electric plug-in hybrid. And we have saved well over a thousand gallons of gasoline.

Carl Martland lives in Sugar Hill, NH. He is a member of the board of the Ammonnosuc Regional Energy Team (ARET), an all-volunteer non-profit organization that encourages and supports economically and environmentally sensible energy practices in the Ammonoosuc Region of Northern New Hampshire. Learn more about ARET and local energy solutions, go to www.ammenergy.org. ♻

Top: Digital display shows fifty-four miles were driven on one charge! Bottom: The author's Chevy Volt. Photos courtesy of Carl Martland.

FORMULA HYBRID

Randolph Bryan

LIVE GREEN OR DIE

Ever wonder where the big car companies' expert electric drivetrain and battery engineers come from? Well, if they intend to change their product lines, the big car companies will have to. There are not a lot of sources for this talent. Yes, there are smart "prototypers" in and around the major car companies, and even the old guys who did the EV1 and other California compliance electric vehicles (EVs) in the 1990s. But compared to the number of engine and combustion engineers and for its driveline components, the EV talent ranks are pretty thin.

As the major car companies are now finding, they can't turn their product lines around quickly, nor well enough, to compete with a talented, nimble and dedicated EV company like Tesla. They thought, until a couple of years ago, that all they had to do was apply their well-backed talent and manufacturing to the problem, and they could emerge the leader in a few years. They were just waiting until the battery industry got their battery costs down to a level where they could make EVs profitably (maybe five years or more from now). Well, Tesla stole the lead a few years ago with their own battery and drivetrain technology ramp-up, to where they now have a few solid years' lead over the majors and are still innovating faster. Even Volkswagen, now the most dedicated major regarding change to EVs, is finding that it takes much longer than they imagined.

Participants at the Formula Hybrid competition in 2019 at the speedway in Loudon, NH. Courtesy photo.

Indeed, several major car companies probably won't survive the technology change intact (think partnerships first, then mergers). The writing is on the wall: find the top talent and get busy, or fade away.

That's where Dartmouth University in Hanover, NH comes in. For over twelve years, the Mechanical Engineering Department at Dartmouth and assorted volunteers (I am one of many) have organized and executed a global college competition to design and build very high-quality hybrid and electric go-carts (think basic cars). The adult talent volunteering at this event is incredible, all thanks to its founding visionary, Doug Fraser, a former Formula1 mechanic at McLaren, now retiring professor at Dartmouth. Mike Chapman is the new leader of the Formula Hybrid event. Every year, 20 to 40 colleges have competed to pass the incredibly demanding build requirements, safety inspections, and on-track time trials of this competition held at Loudon Speedway at the end of April and early May. This happens each year and because the major car and supplier companies have sponsored the competition, they get to see and have first crack at the best emerging talent. And they have used these events like job fairs to recruit talent, even offering signing bonuses to some. It is most rewarding to see Formula Hybrid alumni come back to the event as advisors and to hear of their success at their new jobs. The competition continues this year though some aspects are modified due to the pandemic. Teams will meet on the track in October for their safety inspections and time trials.

New Hampshire is a small state, far from Detroit. But Dartmouth and the Formula Hybrid team have shown how talent and initiative can play with value in the much larger automobile-industry game.

Go Big Green! New Hampshire can make a difference.

I hope that all in the *G.E.T.* readership is healthy and intend to remain so. My best to you all.

Randy Bryan is one of the co-founders of Drive Electric NH. Bryan has been an advocate for electric cars for eight-plus years. His company, ConVerdant Vehicles, has converted vehicles to plug-in hybrids, including his own Prius in 2008, and developed and sold inverters that turn a Prius into an emergency generator. ♻

ALL-ELECTRIC FERRY BOAT:

"Ellen" Surpasses Expectations

"Ellen", an all-electric ferry boat in Denmark. Erik Christensen. Wikimedia Commons (https://bit.ly/3ee5UbW).

The all-electric ferry boat, Ellen, has surpassed all expectations on performance during a trial year in Denmark. On a route that is eleven nautical miles each way, Ellen has been found to operate at double the efficiency of a boat powered by fossil fuels, and it is far less expensive to run. With no fumes and silent operation, 86.3% of passengers said they were either extremely or very satisfied.

Like other electric vehicles, the initial cost of Ellen was a bit higher than if it would have been powered by diesel. The short payback time on the difference, about five years, is short enough that more boats are likely to be built very soon.

For anyone interested in learning more about Ellen, we suggest going to a recent article at CleanTechnica, "Ellen, Denmark's First Electric Ferry, Passes All Tests With Flying Colors," at https://bit.ly/Ferry-boat-Ellen ♻

Our First Long-Distance Trip in an EV

Barb and Greg Whitchurch

In January we took our new Kia Niro electric vehicle (EV) from our home in Middlesex, Vermont to see family in Sackville, New Brunswick. The car is rated at 240 mpc (miles per charge) and the trip is 550 miles, about 12 hours each way. (Spoiler: it went fine.)

Road trips in an EV require finding compatible high-speed DC charging stations and being mindful of how much distance is between them. There are 168,000 gas stations in the U.S. versus about 65,000 individual public chargers at 20,000+ stations as of now, although the increase in charging stations is rapidly accelerating.

The Whitchurches charge their Kia Niro electric vehicle during a long holiday trip. Courtesy photos.

Unlike gas mobiles, EVs require a longer refueling stop. Level 3 (DC fast chargers) take 30 - 75 minutes for an 80% charge, depending on your capacity. This gives you the opportunity to stretch, relax, get something to eat, read, explore your surroundings a little bit, and nap. The much more numerous Level 2 chargers are slower, so more suited for shopping destinations, dining out, theaters, or the home.

ON THE ROAD

We left just before midnight and stopped three times along the way. There are few EV fast chargers between Montpelier, VT and St. Stephen, NB (on the Canadian border). We stopped at the Hannaford in Skowhegan, ME, at a municipal fast charger in St. Stephen, and finally at a station just outside Moncton, NB. There was a free Level 2 charger in Sackville which we used while there to get started on our return trip. All of the chargers we visited were well within two minutes of our path. Heading home, we left during daylight but got home at 5 a.m. The last five hours were through a snowstorm in ME, the White Mountains of NH, and then halfway across VT. The car did great.

AT HOME

EVs typically come with trickle chargers that plug into any 120 VAC grounded outlet, draw about as much current as a toaster oven, and will charge at about 5 mph; we used this for all of our charging for the first year and a half. Then we subscribed to three charging networks but only use them rarely. The average car travel distance per day in the U.S. is about 35 miles. A trickle charger will make that up in about seven hours; a Level 2 charger in just an hour or two. We leave the OEM trickle charger in the car, just in case.

Part of "range anxiety" is the excitement upon approaching a charging station. Will it be working? Will it be occupied? Will I find it? And, if I can't use it, how far to the next one and will we make it? Bear in mind, more and more charging stations are being built, so day by day this becomes less of a concern. In the four years we've been driving EVs, we've only been unable to charge twice. But range anxiety persists. The only glitch we encountered on this trip was one charger that didn't work; it was at a Canadian gas station, and the charger next to it worked fine.

HOW CHARGING WORKS

The website www.PlugShare.com displays charging opportunities and can actually plan your itinerary. Your selected charging services (EVgo, ChargePoint, SemaCharge, Flo in Canada, and ElectrifyAmerica) have their own search apps. EV charge cards operate much like your credit card at a gas pump except you just hold it up to a target symbol; but it's easier to just swipe on the phone app to start the charger. Our LEAF and Niro both show charging stations on their screens and will guide you to those chargers by voice and screen, as can various apps on your cell phone. The cars also show a map showing how far you can still drive on your current charge. Multiple voice and display alarms warn the driver of a low "fuel" level. It's not as complicated as you might think, and we love it.

The Whitchurches own two EVs, two battery chainsaws, and a small battery snow thrower. ♻

Barb Whitchurch and Remi (Saint Bernard dog) at the Jolley gas station on Rt. 2 in Montpelier. In the background are the PV panels atop Caledonia Spirits (caledoniaspirits.com).

STATISTICS: ELECTRIC VS. INTERNAL COMBUSTION ENGINES (ICE) VEHICLES

Greg and Barb Whitchurch

1. In the U.S. alone, car exhaust contributes to one million extra cases of childhood asthma each year. That same pollution contributes to many (but unestimated numbers as of yet) cases of cancer and earlier cancers.

2. EVs are much safer, both in and out of crashes. In the U.S. there are more than 170,000 internal combustion engine (ICE) vehicle fires per year and more than 5,000 gas station fires per year. Both of these situations resulting in deaths and injuries and more than a billion dollars in damage.

3. The total cost of ownership (TCO) for EVs is significantly less than for a comparably-styled ICE cars. We've owned three EVs over the past four years and have yet to need any maintenance done on any of them. It's just wipers, tires and wiper fluid.) The typical ICE drivetrain has more than 2,000 moving parts (wear, maintain, replace, breakdown); an EV has about 22. Less than 25% of the energy burned in an ICE car goes toward moving it around; EVs are more than 90% efficient in this way.

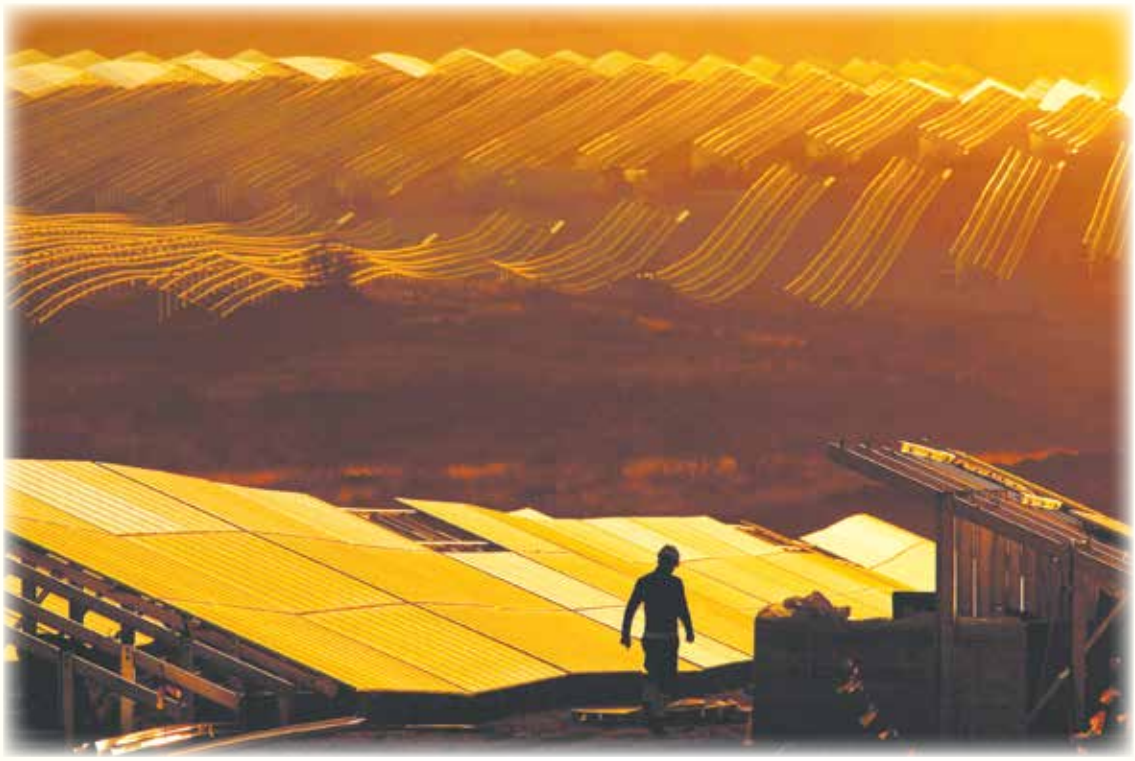
4. The resale value of ICEs will continue to decline at an ever-increasing pace as more folks stop buying them. ♻

Solar Has Not Stalled World-wide In Spite of Challenging Times

George Harvey

We live in times of uncertainty. In the not so distant past, the question was whether we would be able to deal with climate change given that governments are acting so slowly. Of late, that question has been compounded several times.

With the prices of oil and gas going down while Saudi Arabia and Russia engaged in a price war, some people were afraid that renewable energy would not be able to compete. Then, the Covid-19 pandemic came along, and the price of oil fell to negative $40 per barrel, which meant that customers were actually being paid to take the oil off the hands of the companies that owned it (https://bit.ly/3fd20jr). Some people despaired of how solar and wind power could compete with negative costs of oil.



Early morning picture of a solar farm under construction in Spain, showing racks waiting for panels to be installed in the background. This solar farm, which will be the largest in Europe when it is completed, has been under construction as the Covid-19 pandemic raged. Iberdrola image.

However, the low cost of oil, even the negative cost of oil, did not perk things up for that industry. With Covid-19, people were driving less, flying less, and running factories less. The spot price of electricity suffered, regardless of source, for solar and wind as well as fossil fuels. And many people wondered how that would affect the energy industries.

Questions have been raised about capitalization. Where are those who put up the money needed to develop new infrastructure going invest in these times? Will they build up renewable capacity? Or maybe, will it be used to snap up fossil fuel stocks that have extraordinarily low prices and might appear to be good values? These questions have been big worries.

The reduction in demand for energy is the greatest it has been in decades, down 17% from last year at some points and projected to be down 7% for the year as a whole, according to NBC News (https://nbcnews.to/2Ytf0uK). A good side has been often noted as the air cleared, pollution dropped, and carbon emissions fell. We find it very interesting to note that certain kinds of respiratory conditions were alleviated by our response to another respiratory disease.

But the awful truth about this is that as the economy recovers, fossil fuel use is expected to rise again, and with it pollution and emissions. That is actually worse than many people understand.

To deal with climate change, we need to reduce worldwide carbon emissions by as much as the coronavirus response did. And we need to do that every year.

Now comes the good news.

While some analysts expect things to return to "normal," with natural gas and oil going back to usage levels where they had been, it seems many more are seeing the Covid-19 recession as a potential inflection point with the recovery favoring renewable energy. Fortunately, it is that second group that can back their views with facts. I will give a few examples.

Southern California Edison is installing 770 MW of batteries. It will use them to replace plants that burn natural gas. The amount of capacity this one utility is installing is more than was installed in the entire country last year (https://lat.ms/30w9DgO).

The Hawaiian Electric Company (HECO) just ordered

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Solar Power is Moving Forward in our Region!

George Harvey

A 500-MW (AC) array on the site of an old Goodyear facility in Windsor, VT was recently commissioned. It will provide 100% solar power for Harpoon Riverbent Taps & Beergarden. The solar system was installed by Norwich Solar Technologies (NST) of White River Junction, VT. Photos courtesy of Norwich Solar Technologies.

We are living in strange times. Pandemic and recession are jumbled in with climate change in a way that is more than disconcerting. Green Energy Times wanted to find out how this was affecting renewable energy, so a number of solar installers in the area were contacted to find out what their experiences were. Here are some of the things we learned:

Norwich Solar Technologies (NST)

Jim Merriam, CEO of NST, put up a post about recent events, saying, "While we all wait for more normal times to formally celebrate good work, I want to thank the Town of Hartford, VT and the Community Impact Investor Group we sponsor for helping low- and moderate-income (LMI) Vermonters."

He continued, "Recently the Town of Hartford recognized they could use a municipal property to help local LMI residents save money and generate local renewable energy. Many LMI residents face barriers to solar such as renting or coming up with the upfront capital required. By working with local investors who want to make a positive impact, the parties involved were able to create a solar project that overcomes these barriers and creates a win for everyone involved.

The resulting 87kW rooftop installation on the top of Hartford's Public Safety Building is a collaboration with one of our impact investors, Hartford, Twin Pines Housing Trust, and Stewart Property Management. Savings from the solar installation supports the affordability of these LMI housing units located in Hartford, VT. This project once again shows the leadership local government and LMI-housing organizations are actively taking to connect a forward-looking economy to benefitting all Vermonters."

The work for LMI solar power is not the only thing NST has been working on of late. A 500-MW (AC) array on the site of an old Goodyear facility in Windsor, Vermont was commissioned in December. This particular array is significant because of the number of problems that were addressed as it was created.

It is on a brownfield, which limits what can be done with the site and also means that the site needed a certain amount of cleanup to be put to use. In this case, cleanup included removing asbestos from the former factory's concrete slab.

That was not the only problem, however. The site is in a floodplain which had its own implications for NST, as the design went ahead. One implication of this was the electrical connections for the solar array all had to be about six feet above ground.

The off-taker for the electricity produced by the array is Harpoon Brewery, and the Harpoon Riverbend Taps & Beergarden which will be 100% powered by the solar system. Troy McBride, Chief Technology Officer of NST, called this array a "win-win-win," but we suspect that a couple more "wins" could have been added to that, given the project's numerous benefits. McBride did mention one other thing worth passing on to people. He said, another important aspect of the project that needs to be stated was that it was "about the great partnerships." He added, "That project is a great success story."

The NST website is norwichsolar.com.

An 87kW rooftop installation on the top of Hartford, VT's Public Safety Building was also recently installed by Norwich Solar Technologies.

Catamount Solar

Andrew Wible, Catamount Solar's Director of Operations, board member, and employee owner, told us, "Vermonters are resilient by nature. Catamount Solar believes that the clean-energy sector helps families, communities and individuals save money, while providing safety, security, and peace of mind. The solar industry is helping our community rebuild from the coronavirus crisis while simultaneously fighting climate change. During these uncertain times, we have seen a growing interest in solar systems that include batteries, as Vermonters are working toward security and preparation. As a workers' cooperative, Catamount Solar was equipped to weather the

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Solar Has Not Stalled In Spite of Challenging Times

Cont'd from p.8

RP Construction Services, Inc. and the Indiana Municipal Power Agency have partnered on a number of solar arrays in Indiana. The project pictured is in Tell City, IN. Its panels are mounted on DuraTrack HZ V3 single-axis solar trackers. IMPA Courtesy image. For more info, see article at https://bit.ly/3fy2Ck2.

sixteen battery storage systems, thirteen of them with solar arrays. The combined capacity of the solar arrays is 460 megawatts (MW). The batteries will store a total of 2,892 megawatt-hours (MWh) of electric energy, with delivery dates of 2022 and 2023 (https://bit.ly/2BXQ8nj). This will put HECO far ahead of the scheduled dates for moving away from fossil fuels. We might imagine that the lower costs of solar plus storage might have informed their reasoning.

While it is in bankruptcy, Pacific Gas & Electric is adding five battery storage systems for a total capacity of 423 MW, and 1,692 MWh (https://bit.ly/2XOgMqU).

Why is this happening? It does follow legal requirements by states to reduce fossil fuel use, but it is ahead of schedule. An explanation of the timing is that solar or wind energy backed up by massive batteries is cheaper than the natural gas plants of the old energy paradigm. One article at *Utility Dive* says that New York City ratepayers are paying $450 million each year to keep the gas plants going (https://bit.ly/2B1GXkX). Now, the utilities are working on eliminating the natural gas plants and replacing them with batteries that will back up solar arrays and offshore wind farms.

One thing everyone should understand is that the prices of solar, wind, and batteries are falling so fast that costs only a year old are already obsolete. They have fallen so far that a 2,000-MW solar farm is being built in Abu Dhabi that will sell its power, without state support, for $13.50 per MWh. That is 1.35¢ per kilowatt-hour (kWh) (https://bit.ly/3fdzpus). That is only about 20% of the 6.5¢ per kWh the Vermont Yankee nuclear power plant offered to the state of Vermont, saying it was a deal Vermont couldn't refuse.

As to the hackneyed idea, "the sun doesn't always shine and the wind doesn't always blow," we can assign that to history. A recent auction of 400 MW of "round-the-clock" renewable power backed up by batteries was won by the Solar Energy Corporation of India at a price of 3.8¢ per kWh, a price outside the range of what natural gas can compete with (https://bit.ly/30raBuR).

Solar power in sunny Arabia or India is admittedly a bit more productive than it is in Vermont, or in much of the United States, but not enough to make natural gas, oil, or coal attractive here.

Finally, a return to the bad news. Reducing CO_2 emissions will not stop the rise of CO_2 levels in the atmosphere. To do that, we have to eliminate CO_2 emissions altogether. That means we burn no coal, no oil, and no natural gas at all (https://www.co2.earth). ♻

Tax Relief For Renewable Energy Projects

The Treasury Department and the Internal Revenue Service extended the "Continuity Safe Harbor" provision providing some tax relief for renewable energy projects already underway. Notice 2020-41 (https://www.irs.gov/pub/2020-41.pdf) adds an extra year to some projects that began construction in 2016 or 2017, such that if these projects are placed in service in five years, construction will be deemed continuous. Notice 2020-41 also provides a 3½ Month Safe Harbor for services or property paid for by the taxpayer on or after September 16, 2019 and received by October 15, 2020.

Find additional information about the Continuity Safe Harbor extension and about tax relief for businesses affected by the COVID-19 pandemic at IRS.gov. ♻

Working Together: Fortress Battery and Green Mountain Solar

George Harvey

In Hinesburg, VT, 24 LG panels enjoy clear-blue summer skies to power the home and charge the Fortress back-up-energy-storage system. Photos courtesy of Green Mountain Solar.

Fortress Power

Regular readers of Green Energy Times might have read "Battery Storage Choices Grow with Fortress Power," an article that was published in January of this year (https://bit.ly/GET-Fortress). That article should serve as an introduction to the relatively new battery company, which is based in Pennsylvania. A local solar company, Green Mountain Solar (GMS) has installed Fortress Power's (FP) lithium ferrite phosphate ($LiFePO_4$) batteries in two homes that wished to add backup-battery storage to their solar systems.

FP is a company that really prides itself in the support it gives its customers. The products are designed to be user-friendly. Their systems are very long-lived, designed for 6,000 cycles to 80% depth of discharge (DOD). You might compare that with some lead-acid systems that are sometimes only good for approximately 500 cycles down to a 50% DOD.

Recently, FP has added another battery to its lineup ranging from 5.2 kilowatt-hours (kWh) to 18.5 kWh. The company has introduced a new model, the eFlex 5.4 kWh. Their batteries are suitable for simple battery backup, off-grid installations with solar power, and in combination with solar power for grid-tied solar systems, thereby reducing higher time-of-use charges during high-demand times, demand-charge curtailment.

Green Mountain Solar

Green Mountain Solar (GMS) is based in Williston, Vermont. Paul Lesure is the general manager. The company has been installing solar systems since 2017, with a diverse set of projects including roof, ground-mounted, and tracker systems, both for residential and commercial properties. They shared their experience for two solar installations in Vermont that included batteries from FP.

Project manager Robert Dunn told us "GMS has seen a significant rise in interest in grid-tied battery storage systems, and for good reason. Customers are enjoying the security of knowing that there will always be power, even in the worst weather. This extends far beyond just the lights staying on. It means that if you have electric heat, a bad ice storm won't turn your home into an igloo. It means that you never have to worry about a fridge full of food spoiling after a summer thunder storm. And, at a time when people are relying on digital solutions for working and connecting, the internet will never drop out unexpectedly."

The two Fortress Power batteries, the two white boxes at the lower right, can keep almost the entire home running in case of an outage.

Hinesburg installation

The first of our example projects was installed in June 2019, in Hinesburg, Vermont. This is actually a somewhat complicated system, because the homeowner uses quite a lot of power most of the time and needed 50 solar panels to cover that need. The battery system is not designed to accept all that power, however, because usage would be very much reduced during times of outage. As a result, the solar system has bifurcated power delivery, with only 24 panels supplying power to the batteries.

The solar-plus-battery system includes 24 LG Neon2 335 W panels, each with an Enphase IQ 7+ Micro-inverter. The system also has a SolArk 8k hybrid inverter and a Fortress Power $LiFePO_4$ 10-kWh battery. This system can power the home's lights, outlets, water pumps, pellet stove, home entertainment center, and the electric induction stove top when used sparingly. It was designed for 12 to 24-hours of operation, even in the winter, providing a high level of resilience. It accomplishes this without the fuel and maintenance needs of a generator, and without the environmental impact of the fumes a generator would give off, or the maintenance that they require.

Middlesex installation

The second and more recent example is a system installed in January 2020, in Middlesex, Vermont. Dunn said, "This system was one of our first 'Whole Home Minus' installs, meaning that all but a few very high-draw appliances would be backed up in the event of a grid outage."

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It's a Busy Time for Solar in Nashua, New Hampshire

George Harvey

ReVision Energy has just installed three solar arrays in Nashua, New Hampshire. The three arrays, sited at the municipal transit garage, the Lake Street fire station, and the Conway Arena, have a total capacity of 640 kilowatts, which are provided by 2,027 solar photovoltaic (PV) panels. Combined, they will reduce carbon emissions by about 350 tons per year.

Together, the three arrays form an important part of Nashua's drive toward carbon-free sustainability. According to Mayor Jim Donchess, Nashua has goals of 25% reduction in carbon emissions by 2025 and carbon neutrality by 2050. The city has already been actively working on those goals through a variety of measures, including installing LED street lighting and acquiring two hydroelectric dams. The city also hired an energy manager.

The array at the Conway Arena, an ice rink, was the largest of the three. Installation of its 1,296 PV panels was done over the last two months of 2019, and the PVs were already generating electricity before the beginning of this year. A ribbon-cutting ceremony took place at the Arena on March 3, and Mayor Donchess proclaimed it "Solar Day" in Nashua.

At the ribbon cutting, Donchess spoke of his city as a solar leader for the state, stressing the hard work being done there. Dan Weeks, ReVision Energy's Director of Market Development, agreed, saying, "Nashua is truly at the forefront of this transition to clean energy."

The three installations are all based on power purchase agreements. ReVision Energy, which installed the panels, maintains them, and they are owned by Worthen Industries. Taking the Conway Arena as an example, the price of electricity is 8.8 cents per kilowatt-hour, and this may increase at a rate of 2% per year. The city has an option to buy the array in the sixth year. The agreement is expected to save the city $1.3 million over a period of forty years.

Nashua is setting out to continue work on renewable energy for a future free of carbon emissions. The three arrays that have been finished so far will be followed soon by more. One will be installed at the Dr. Norman W. Crisp Elementary School and another at the Fairgrounds Middle School. Both will be installed by ReVision Energy.

The financial arrangements for the up-coming arrays will be similar to those that were completed. The investor is not yet confirmed, but the expectation is that the schools should be able to buy them any time after the end of the first five years.

Potential investors who are unfamiliar with the concept of local impact investing might do well to look into it. Impact investing is done with a view to achieving specific results, in addition to providing returns. For example, a person interested in slowing climate change might invest in a solar array, a wind farm, or manufacturers of carbon-free generating equipment. When an impact investor wants to promote a cause in a specific place, that is local impact investing. An inducement for this kind of investing is tax credits. ReVision has more on this at its website at impact.revisionenergy.com.

"Under the terms of the RSIP program, impact investors provide capital to build solar projects. Investors earn a modest rate of return through payments made for solar generation, tax incentives, and other project benefits, while solar installers benefit from a steady pipeline of work. The entity entering into the agreement receives a reduced electric bill. ReVision Energy continues to seek out impact partners for future projects. Learn more at revisionenergy.com/solarimpact." ♻

ReVision Energy installed three solar arrays in Nashua, NH that have a total capacity of 640kWs, provided by 2,027 solar photovoltaic (PV) panels. The arrays are: top left: the Conway Arena; top rt: the municipal transit garage; above: the Lake Street fire station. Photos courtesy city of Nashua.

Backup Power Systems for the Home: Batteries When the Grid Fails

Danielle Ferguson

North Carolina residents will tell you that they may have hurricanes, but at least they don't have blizzards. Buffalo natives will say sure, they have blizzards, but at least they don't have wildfires. Californians will say the beautiful climate makes up for the risk of wildfires, and at least they don't have tornadoes. Texans, well, they seem to deal with a bit of everything. And then coronavirus comes along and makes a fool out of all of us.

No matter where you live, there will be at least that one extreme weather event that could leave you without power. Having a battery backup power system can make those challenging times a little more manageable and protect your home and family.

When the grid goes down, often the electric lines do, as well. Lines in Burlington, VT. Artaxerxes, Photo: Wikimedia Commons, https://bit.ly/30Ys5yU

Backup power systems are energy storage devices that can be quickly turned on to power your home. They're not the same as an "off-grid" electrical power supply like rooftop solar panels. Backup systems do not feed into your home during normal circumstances. They don't help you disconnect from the grid: they hold a reserve of energy ready to help you when the grid disconnects from you.

Every backup power system needs an energy source

Generators are the most common backup power device, and they run on diesel fuel or natural gas. That's the root of many of their drawbacks.

The combustion process is the same as in diesel- or gas-powered vehicles, which means they are noisy and, in the case of diesel, release a lot of exhaust emissions. With diesels, they also require similar maintenance procedures as other diesel engines, such as oil changes and additives to ensure the fuel does not break down during long-term storage.

Second, for the generator to keep supplying you with power, you have to keep supplying it with fuel. Since we're talking about extreme weather or other emergency situations, you should think about whether you would be able to buy and transport fuel if roads are shut down or impassable, services are compromised or the fuel supply chain is unable to meet demand. If all the nearby gas stations took the hit as hard as your house, you may only have as much electricity as the one tank of fuel you have on hand.

Third, the amount of power you want your generator to provide will significantly affect the size, cost and installation requirements of the generator.

If you want a generator that can power your entire house, you'll need a permanently installed generator that connects to your home's electrical panel via a transfer switch. The equipment and professional installation will be very expensive. If you want a generator that can power a few appliances for short periods (e.g., air conditioner, freezer), a portable generator that you connect to the appliance with regular extension cords will suffice.

The following factors capture why batteries are replacing generators as backup power systems.

Batteries are less intrusive and more reliable

Batteries are zero noise and zero emission, making them more comfortable for you and your neighbors to have in service. They require little maintenance beyond ensuring the batteries are fully charged. While generators cost less per kilowatt-hour than batteries at the point of sale, maintenance and fuel costs make generators more expensive over the life of the unit.

Batteries can also be more independent than generators when it comes to replenishing their energy supply.

Batteries and solar power make a good combination, because they work well when the usual energy supplies, like the electric grid and gas stations, are unavailable or inaccessible. Solar panel arrays can be connected to recharge your batteries as well as power your home. In a situation where you are without electricity from the grid for a few days, the combination of solar power during the day and solar power-charged batteries overnight can minimize the disruption to your home's power.

Battery-backup systems are more flexible in terms of the space you need for them. Generators and their fuel tanks need to be outside, for obvious safety reasons. This can make them a non-starter for people without enough space in their yard, or if housing covenants or regulations crack down on some combination of the intrusive installation, noise or emissions.

Battery-backup systems, on the other hand, require less space and can be inside the residence, therefore are accessible to a wider range of residences.

Danielle Ferguson is the marketing manager at RELiON Battery. Learn more at relionbattery.com/solar, 404.915.3015. ♻

RELiON LiFePO4 RB48V 100 Ah Battery

Lithium Batteries and Medical Facilities: Reliable Power for Essential Care

Essential work needs reliable power at all times. Emergency Entrance, Glens Falls Hospital. JBC3, Public domain, https://bit.ly/3efcfDP.

"Essential" has become one of the defining words of 2020. Hospitals have always been essential to human health and flourishing, but we have a new appreciation for them after the COVID-19 crisis.

Hospitals operate under strict requirements for their power supplies. Modern medicine places high and stringent engineering demands on medical facilities and equipment. A few ways lithium batteries can support the medical community are:

- Alternative or uninterruptible power supplies for hospitals.
- Reduced downtime for carts and components.
- Mobile power for mobile medical facilities.

Read more at https://bit.ly/power-for-essential-care. ♻

FEDERAL

FEDERAL INVESTMENT TAX CREDIT

• The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 30% of expenditures. For commercial geothermal generating systems, microturbines, and combined heat and power the ITC is 10% of expenditures.

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

• Electric Vehicles - Tax credit for qualified plug-in electric drive vehicles including passenger vehicles and light trucks. For vehicles acquired after December 31, 2009, the credit starts at $2,500 and goes up to $7,500 based on the battery specs.

USDA RURAL DEVELOPMENT PROGRAM

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

• Finance the purchase of renewable energy systems, and make energy improvements; energy audits. Funding is awarded on a competitive basis; grant funding cannot exceed 25% of eligible project costs and combined loan guarantees and grants cannot exceed 75% of eligible project costs.

• Applicants include Feasibility studies/ regular REAPs: agricultural producers and rural small businesses. Energy audits and renewable energy development assistance: local governments, tribes, land grant colleges, rural electric coops, public power entities. Grant must be used for Construction or improvements, purchase and installation of equipment, energy audits, permit fees, professional service fees, business plans, and/or feasibility studies. Find more at www.rurdev.usda.gov/NH-VTHome.html or call 802-828-6080 in VT or 603-223-6035 in NH

BIOREFINERY ASSISTANCE PROGRAM

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

The Biorefinery Assistance Program was established to assist in the development of new and emerging technologies for the development of advanced biofuels and aims to accomplish the following:

• Increase energy independence
• Promote resource conservation, public health, and the environment
• Diversify markets for agricultural, forestry products and agricultural waste materials
• Create jobs and enhance economic development in rural America
• For more information go to www.rurdev.usda.gov/BCP_Biorefinery

REGIONAL

NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

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

• Must be volunteer driven or have up to 2 full time paid staff or equiv.
• have an annual budget up to $100,000
• "Seed" grants of $250-$1,000 and "Grow" grants of $1,000-$3,500
• Go to www.grassrootsfund.org/grants/ or call 802-223-4622 for more info.

VERMONT

CLEAN ENERGY DEVELOPMENT FUND

The Small Scale RE Incentive Program, administered by Renewable Energy Resource Center (RERC), provides funds to help defray the costs of new solar thermal and advanced wood pellet heating systems.

Advanced Wood Heating Advanced wood pellet heating systems -- $6,000 per pellet boiler/furnace (in partnership with Efficiency Vermont). Details at www.rerc-vt.org or call (877) 888-7372.

• Retails sales of "Advanced Wood Boilers" are exempt from Vermont's 6% sales tax. http://tax.vt.gov/exemptions,,
• **Details at https://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

• For wood heating (pellet or chip boilers/ furnaces) in municipal buildings, schools, and non-profits contact the Windham Regional Commission: Marion Major at 802-257-4547 ext. 109 or windhamregional.org/energy/wwh

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

Pellet Sap Evaporators:

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

Other Utilities Heating Offers

• Members of Washington Electric Co-op (WEC) can get a $1000 rebate on approved pellet boilers and $500 for pellet furnaces. This can be combined with the CEDF and EVT 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 EVT.
• 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 7.2% state-level credit for systems and for geothermal electric, microturbines, and combined heat and power systems, this constitutes a 2.4% state-level tax credit.

Tier III programs

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

EFFICIENCY VERMONT

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

Lighting

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

Weatherization

• Comprehensive air sealing and insulation projects with an Efficiency Excellence Network contractor: 50% off eligible project costs, up to $2,000. Moderate income Vermonters get up to $4,000 back.
• 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 - $400 rebate
• Appliance recycling: $50 + free pickup of secondary refrigerators, standalone freezers, dehumidifiers, and window air conditioners.

Heating/Cooling/Water Heating

• Central wood pellet boilers and furnaces: $6,000 rebate (in partnership with CEDF)
• Heat Pumps:
  • Air-to-Water System: $1,000/ton rebate
  • Centrally-Ducted System: $800/ton rebate
  • Ductless Heating & Cooling System: $350-$450 discount at participating distributors
  • Heat pump water heaters: discounts up to $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.

Wood Stove Change-Out

CEDF Change-Out

• Customer must have an existing/ installed non-EPA certified stove to change-out:
• Pellet stoves: $1,000 incentive*
• Cord wood stoves: $800 incentive*
• * These incentives end Dec. 16, 2019
• A $100 incentive is also available to replace the catalyst in an existing
• EPA-certified woodstove.
• $300 fed. tax credit now available on 2019 and 2020 stove purchases.
• Efficiency Vermont offers a $650 rebate for a new pellet or cord wood stove. *
* Cannot be combined with above offer.

Residential New Construction

• Enroll to receive a home energy rating, expert technical assistance, and incentives – Efficiency Vermont Certified™ projects receive up to $3,000 cash back
• Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives

Commercial and Institutional

• Buildings over 5000 square feet can get a rebate of $1.25/sf up to $50,000 from Efficiency Vermont, plus an additional $3000 from the CEDF.

Other Opportunities To Save

• Advanced Power Strips – special pricing starting at $6.95
• Pool Pumps – up to $500 back on select ENERGY STAR models
• Home Energy Loan – low-interest loans of up to $40,000 for energy-related home improvements. First 6 months of loan payments covered for a limited time (up to $900).

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

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

Commercial Solar Rebate Program

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

Incentive levels for PV systems are as follows:

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

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

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

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

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

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

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

NH Home Performance with ENERGY STAR

Sponsored by all NH electric and natural gas utilities in partnership by the U.S. Dept. of Energy. Fuel-blind eligibility using the Home Heating Index (BTUs of heating fuel / conditioned square feet / heating degree days). Must provide at least 12 months of heating fuel history. Once qualified, eligible homes get a $450 value comprehensive energy audit for $100 (rebated if improvements installed), and 50% instant rebate for eligible weatherization improvements up to a $4,000.

• 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/appliances.

• 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 certain ENERGY STAR® certified LED light bulbs purchased through participating NH retailers, and instant or mail-in rebates available on ENERGY STAR® certified light fixtures (varies by retailer, see store associate or rebate form for details). Infor: NHSaves.com/lighting.

• 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 MassSave 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 Eversource 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 websit3: 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.nyserda.ny.gov/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 infor 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

Caledonia Spirits: A New Sustainable Distillery

George Harvey

Caledonia Spirits (CS) is not just extraordinary. It is not merely unique. It is unique in a number of ways. Its main products are Barr Hill Gin, Tom Cat Gin, and Barr Hill Vodka. Of late, it has also been producing hand sanitizer, both for its own use and to provide to other organizations.

As many of us know, gin is usually made from spirits of fermented grain or some other sugar source, with juniper berries added for flavor. Vodka is also usually made from fermented grain or potatoes. The CS offerings however use honey as the sugar source for their fermentation.

Caledonia Spirits' new facility has an 84-kilowatt (DC) solar array. Image: SunCommon

CS was started by a beekeeper, Todd Hardy, nine years ago. In addition to a loyalty to the bees, he instilled other values of his own into the company, and though he himself moved on in 2015, CS continues with these original values.

Hardy had wanted to support the local farms, both in terms of products and for getting those products to market. He sourced materials as much as possible from local farms, and the honey the company uses all comes from within 250 miles of Montpelier.

Readers with a sharp eye for details may notice that very few ingredients are listed in CS products. Barr Hill Vodka is made with a single ingredient – honey. Barr Hill Gin starts as a neutral spirit, is then distilled with juniper, and finished with honey. CS buys something over 80,000 pounds of honey each year, which is used in a raw state. The difference between Barr Hill Gin and Tom Cat Gin is that the Tom Cat Gin is fermented in oak barrels, which impart a flavor much like that of whiskey.

CS is testing other source materials that also could be sourced locally through their Experiments in Agricultural Rectification (or EAR) program. Harrison Kahn, the Vice President of Marketing, told me one very interesting possibility is burdock root. He said the distilled product tastes very like agave.

The CS team outgrew the Hardwick distillery and it was time to find a bigger home. CS found a home in Montpelier and moved there in July of 2019. Looking at the move, the effects of Todd Hardy's sustainability values start to become clearer.

Kahn told us, "Distilleries are typically not very sustainable." Then he proceeded to explain how CS is different. "We moved from Hardwick to Montpelier so everyone could be under a single roof. We built on a brownfield, and the city was glad to get use of it. It had fill from granite industry. We were able to build by dynamic compaction, so nothing had to be trucked out."

The new facility has an 84-kilowatt (DC) solar array, which was installed by SunCommon. The array offsets all of the electricity used to make the two brands of gin, which require use of a condenser with an electric chiller. The new building also has a lot of natural light, which is combined with automatic dimmers and LED lighting to reduce use of electricity. CS has electric car charging. Also, simple construction used insulated panels to reduce heat loss.

The amount of water CS uses has been drastically reduced in the new facility. Kahn said of this, "We reduced water use by 83%." While that seems to be a huge improvement, he added, "There are still opportunities." Low flow plumbing was one of the things that reduced water use.

CS tries to compost everything. It sends all of its organic waste to local biodigesters where it can be used generate electricity. It does not use a lot of packaging, but where it is needed, the company reuses packing from things it had received.

CS has its own bar, which is also sustainably operated. The fresh ingredients are products of local farms. When it reopens after the coronavirus pandemic abates, those who might want to visit can use a public footpath to get there from downtown Montpelier. Before they go in, they might want to pause and notice the pollinator-friendly plants in the landscaping. ♻

CS Gin on a beehive. Image: Randy Hazleton. Inset: CS Gin and sanitizer. Courtesy image.

Thank you to our sponsor:

BARR HILL

Solar in our Region

Cont'd from p.9

storm as a team by finding ways to work toward the future and help our community. We continue to see growing interest and feel strongly that the solar industry will prove to be an essential force in rebuilding our local economy."

Catamount Solar's website is catamountsolar.com.

Green Energy Options

Pablo Fleishman, owner of Green Energy Options said, "I think we are going to have a good year, considering everything. People are still interested in solar. We had contracts we thought were going to disappear, but they seem to be coming back. When our states shut down, no one knew how to think, but now they are going back to work. We are going to take a hit this year, because we have already lost three months, but we have hopes for the year anyway. We are going to have to hit the ground running to accomplish what we have in years past."

The Green Energy Options website is greenenergyoptions.com.

A recent 6.32kW rooftop solar installation by Green Energy Options (GEO Solar), Keene, New Hampshire. Photo from Simon Gray, Green Energy Options.

Integrity Energy

Amos Post, founder and CEO of Integrity Energy, told us that his business is moving along at a very quick pace. "Things are very busy here," he said. "We have some very neat projects in the pipeline, and we are actually experiencing a summer solar slam."

Integrity Energy's website is ienergyvt.com.

O'Meara Solar

Darren O'Meara, partner of O'Meara Solar, said he and his business were doing well. He said, "We are having a good start to the year, at least average. Early in the year, there was a fair amount of uncertainty. Grid-tied installations are a bit slower, but off-grid systems have had an uptick." He said he thought some people who live in cities want to be prepared to go to safe havens in the country, free of worries about electric power. He told us, "As for $LiFePO_4$ backup batteries, I have installed two RELiON systems, and one Simpliphi for off-grid, and two Sonnen grid-tie systems. I do have two more Simpliphi installs going on in the next month."

The O'Meara Solar website is omearasolar.com.

ReVision Energy

Kim Quirk, the manager of ReVision Energy's office in Enfield, New Hampshire, gave us a representative and very clear, response. "Things are moving along with a lot of projects that people could do," she said. "Sales were down a little when the coronavirus hit, but they are picking up again." She said the chaotic things that are happening, the pandemic and recession, make people open up to looking at ways they can take control of their lives. There has been an increase in the number of battery-tied systems ReVision has been installing. A good solar system with backup can do a lot for confidence in hard times. Mostly, her branch is installing Tesla or Generac lithium-ion systems designed to provide backup and load-leveling services.

ReVision Energy's website is revisionenergy.com.

The trend in the local solar industry seems to be following worldwide advancement in solar capacity being installed. Installers in areas of high rates of coronavirus infection are often heartened by the fact that solar installers do not generally need to be closer to each other than social distancing would require, and so they can continue to work without great slowdowns.

The global recession that is upon us has similarly not had a great effect on the solar industry in many places. While recession usually makes people afraid to spend money, the solar industry is benefiting wherever it can show reduced costs for the customer. And that, fortunately, is nearly everywhere. ♻

More Power Is Coming from Renewables Than from Coal

George Harvey

In the first quarter of 2020, renewable power sources produced more electricity than coal in the United States, according to information from the Energy Information Administration. Given that winter is one of coal-fired power's most productive times, this is big news. Now coal's problems have been exacerbated by the coronavirus pandemic.

Historically, coal has provided baseload power at plants that were designed to take advantage of efficiencies of scale by running at full capacity all the time. This meant that they could produce very cheap electricity. But it also meant that if demand fell below the base load, the minimum load demand for the year, at least some of them would have to shut down, and that is expensive.

If the demand is above the base load, which it nearly always is, the extra has been taken up by load-following plants, which can change production as demand changes. Where baseload plants take many hours to change their output, load-following plants can do the job in minutes. Even that is not really good enough for high quality electricity, so an ideal grid also has peaker plants, which can change output in seconds. Electricity from load-following plants, however, is expensive. And peaker plants cost even more.

That is the traditional paradigm with the introduction of solar and wind power, which have varying output. Their variability, however, is a sometimes an asset, because they can be curtailed very quickly to prevent the grid from overloading. There are also other kinds of renewable power with very different limitations and advantages. Hydropower, biogas, and geothermal are among them. And all of these can be firmed up with batteries.

Wind turbine and coal smoke stack. Roland Peschetz, Wikimedia Commons. https://bit.ly/coal-vs-wind.

Coal was first threatened several years ago by falling costs of electricity from combined-cycle natural gas plants, which are also baseload power plants. According to Lazard Associates' Levelized Cost of Energy and Levelized Cost of Storage 2019, the cost of electricity from coal, at $66 to $152 per megawatt hour (MWh), is nearly always higher than the cost of baseload power from natural gas, which ranges from $44 to $68 per MWh.

But now, both natural gas and coal are threatened by the ongoing reduction in costs of solar and wind power. Add to that the fact that costs of batteries have been tumbling at a remarkable rate. The result is that renewable power, even if it is to be available 24/7 by use of huge batteries, is often less expensive than the cheapest baseload power provided by fossil fuels. The thing is, renewable power and batteries are not replacing coal plants; they are replacing baseload, load-following, and peaking plants combined.

A recent reverse auction in India looked for 400 megawatts (MW) of renewable power, with the catch that it had to be available around the clock, 24/7. The winning bid, out of 950 MW of proposals, was for 400 MW at $38 per MWh. That is lower than the lowest cost for baseload power, and without any need for load following and peaking plants. It does this regardless of whether the sun is shining or the wind is blowing.

Change is under way in the United States, as large batteries come online, backing up wind and solar power. In fact, Southern California Edison has just signed contracts for 770 MW of battery backup, to be delivered by August 1, 2021. That is more battery storage than the entire country had in 2019.

We have come to a point where there is no need for baseload plants, load-following plants, or peaker plants. And since the response time of batteries is better than that of peaker plants, the electricity has better quality.

Now, because of the COVID-19 pandemic, the demand for electricity has fallen. This has not pushed renewables off the market, however, because they provide energy at lower cost. It is cheaper to balance a grid dependent on renewable energy than to pay for energy from coal-burning plants. Since big power plants, running on coal, gas, or nuclear power, take a lot of employees, who have to work in conditions where social distancing is not feasible, the COVID-19 pandemic may even tip the scales further in favor of renewable power.

The Energy Information Administration has published the data for the first quarter of 2020. In that quarter, Coal produced 171,828 MWh, or 17.86% of our electricity. By contrast, renewable resources, including hydro, solar, wind, and others, produced 201,902 MWh, or 20.99%.

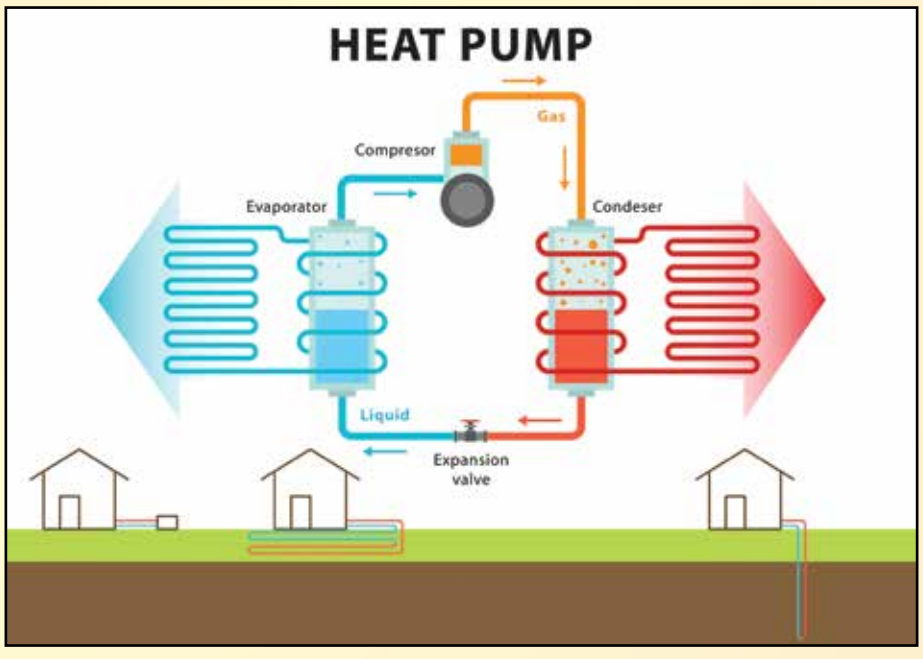
On a day-to-day basis, renewables have beat coal generation on 100 out of 148 days. They have beat coal for the last 60 days in a row. The consensus among energy industry analysts is that things are not likely to get better for coal. It looks like its place may be in history books. ♻

Heat Pump Magic

Bruce Sullivan

We take it for granted. Refrigerators draw heat from inside a cold cabinet, and they reject that heat into the surrounding air. You can feel the heat in the space behind a refrigerator. Pulling heat out of seemingly cold air may seem like magic. But it's just basic physics. The principle of refrigeration was first discovered in the 1700s and an early version of the technology was commercialized about a hundred years later. So, it's not magic. It's not even new. During the 20th century, refrigeration technology in the form of "air-conditioning" expanded into automobiles and entire buildings. Soon air-conditioning became a modern necessity. While early practice focused on cooling and dehumidification, the physical principle has been adapted to work in either direction – expanding the magic to space heating as well as cooling applications. Now, specialized refrigeration products can dehumidify air, dry clothes, and heat water.

When air-source heat pumps for space heating first appeared on the market, they were basically air-conditioners that had been adapted to operate in reverse. They were limited to warmer climates and mild heating seasons. Gradually, the technology improved with a surge of efficiency. Over time, engineers have expanded the range and function of heat pumps so they work well in colder climates, too. While it may seem like magic, heat pumps are all based on science. The technology employs several basic principles of physics to attract outdoor heat, concentrate it, and move it between indoors and outdoors. Understanding the science will help you understand and appreciate what a wonderful contribution air-source heat pumps are making to zero energy homes.



Energy Moves

In nature, nothing remains still. Heat is always moving from areas of higher temperature to lower temperature. If you want to attract heat, you must present a surface that is cooler than its surroundings. To reject heat, present a warmer surface. Although an air temperature of zero degrees seems cold, there is actually quite a lot of energy in that air. To attract this energy, a heat pump presents a cold surface to the outside air in the form of a fin-and-tube heat exchanger in the outdoor unit.

A heat pump's outdoor unit captures heat, concentrates it and moves it to the indoor unit. The system can be operated in either direction for heating or cooling.

To function, the outdoor heat exchanger must be quite a bit colder than the outdoor air. Similarly, to send heat into the indoor space, the indoor heat exchanger must be warmer than the indoor air. So, how does it make cold on the outside and warm on the inside?

States of Matter

All matter comes in three states: solid, liquid, and vapor. To keep things simple, let's look at water which we see every day in all three states. It takes one British Thermal Unit (Btu) of energy to raise one pound of water one-degree Fahrenheit. (This happens to be the definition of a Btu.) If you start with liquid water at 32°F and apply 180 Btus, you have liquid water at 212°F – the boiling point of water. But wait, shouldn't liquid water become vapor at this point? Not yet, because it takes 970 Btus more energy to turn this water from liquid to vapor. That's five times MORE energy to change the state from liquid to vapor than it took to raise the temperature of the water. This is called the energy of vaporization or evaporation.

Refrigeration technology captures this principle of physics to move energy from one place to another using a refrigerant. There are many types of refrigerants, but they all share an important property. They evaporate – or vaporize – at a very low temperature.

Pressure and Temperature

In heating mode, a heat pump circulates a very cold liquid refrigerant through the outside coil. Because the refrigerant is colder than the outside air, the liquid vaporizes even at a temperature people consider cold. The refrigerant captures a lot of energy and becomes a gas that can be pushed inside the building. The pushing is accomplished by a compressor, but moving the energy-rich gas is only one of its functions. The compressor also squeezes the gas, increasing its pressure. When pressure increases, so does temperature. So now, the gas is hot and moving through a heat exchanger inside the building. Here the refrigerant condenses back into a liquid, releasing the same amount of heat that it absorbed in the outdoor coil plus the heat added by compression. A fan circu-

Cont'd on p.18

Cleaning Heat Pumps

Jessie Haas

Heat pumps are such a game-changer, heating or cooling our homes using electricity. And doing it cleanly?

Yes, if we clean them, which is something many home-owners don't take into consideration. But failure to properly maintain mini-splits can have an impact on both efficiency and health.

If cleaned, heat pumps remove mold and bacteria from indoor air. If not maintained on schedule, however, they accumulate dust, dirt, hair, mold, pollen, and grease on the fan and coil, a breeding ground for bacteria which they then circulate. They can also lose 10-25% of their energy efficiency. An annual cleaning by a professional usually pays for itself in terms of electricity costs, with improved indoor air quality as icing on the cake.

Heat pumps get dirty and every heat pump requires annual cleaning. Images WeCleanHeatPumps.

But isn't this something that can be done by the homeowner? No, according to Gabriel Erde-Cohen, owner of WeCleanHeatPumps in Westminster, Vt. Monthly cleaning of filters is essential to keeping a heat pump working efficiently. But most people only use a vacuum cleaner or acidic spray, which Erde-Cohen likens to washing your hands with cold water and no soap. It's a superficial clean which doesn't get at the gunk deposited on the coils. These are easy to damage; improper cleaning can leave them bent and rusting, and require costly repairs.

The technicians at WeCleanHeatPumps use specialized tools, a calibrated low-pressure washer, and biodegradable, non-toxic, non-acidic soap to clean deep inside the interior and exterior units, areas the homeowner never sees. "People don't really know why I'm there until I start cleaning," says Erde-Cohen. "If I invite a homeowner to watch me clean, they always understand."

Erde-Cohen got into this business when his wife and father-in-law, heat pump installers with Saxtons River Solar, needed someone to clean the units they install. Erde-Cohen bought the specialized equipment and gleaned information on the internet from technicians in other countries. WeCleanHeatPumps is the first company in the U.S. focused solely on heat pump cleaning.

The environment is a strong motivator for Erde-Cohen, whose background is in small farming. Dirty heat pumps use more energy and deliver less heat or cooling. They're a drain on the electrical grid. "I want to clean all of them," Erde-Cohen says.

But indoor air quality is turning out to be the prime motivator for his customers. The difference can be dramatic. Customers mention that they've been sick for years, and that the deep cleaning provided by WeCleanHeatPumps has greatly improve their health. That's even more important now, in the time of Covid-19. "I'm not going to claim that we can stop a virus," Erde-Cohen said, but notes that air quality has been a significant factor in infection outcomes. As people spend more time at home, indoor air quality has become even more important.

WeCleanHeatPumps employs seven people, and serves Vermont, contiguous areas of Massachusetts, New York, and New Hampshire, and Martha's Vineyard. The company creates partnerships with installation companies, and cleans all of Green Mountain Power's leased units, as well as setting up annual contracts and one-time cleanings with individual home-owners. Technicians work alone; the job takes about an hour and a half, and the slurry of dirt and soap removed from the heat exchanger—gross, but biological in origin—can be safely dumped in the drain gutter or on the driveway.

Erde-Cohen sets prices so that he can pay his employees well, and make the cleaning pay for itself in electricity savings. Clean, filtered indoor air is a free and valuable bonus. Learn more at www.wecleanheatpumps.com.

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

Heat Pump Magic

Cont'd from p.17

coils delivering the heat to the room. This process is highly efficient because the compressor and two fans are the main components that use energy. There is no combustion of fossil fuel or an inefficient electric resistance coil.

Refrigerants Evolve

Water can be used as a refrigerant although its properties are not ideal. Fifty years ago, chlorinated fluorocarbons (CFCs) were common. Many people remember Freon, a brand name for the refrigerant R12. CFCs were phased out through the Montreal Protocol because they destroyed the ozone layer. Ammonia is used as refrigerant in large industrial systems. Many modern air conditioners and heat pumps now use hydrofluorocarbons (HFCs) such as R134a and R410a. While these are ozone-friendly and have many other admirable properties, these HFC-based refrigerants are strong greenhouse gases. If they escape from the sealed heat pump system, they have a powerful warming effect in the atmosphere. Refrigerant production and use are regulated and heat pump installers must be licensed. Nevertheless, HFC refrigerants are causing harm to the climate. They are already being phased out and will soon be replaced with ozone and climate-friendly alternatives.

One refrigerant with a low global warming potential (GWP) is carbon-dioxide. CO2 has a GWP of 1. It is used in the Sanden Heat Pump Water Heater. A new class of refrigerants is entering the market called hydrofluoroolefins (HFOs) which have a global warming potential similar to carbon dioxide. These low GWP refrigerants are now on the market under the brand names Opteon and Solstice. Both products can be used to replace the HFC refrigerants in existing HVAC equipment. Better still, new HVAC products are being developed to utilize these low greenhouse gas emitting refrigerants.

Unfortunately, the Federal Government just reversed regulations on large-scale refrigeration systems, such as supermarket equipment, which will undoubtedly lead to massive leakage of CFC and HFC into the atmosphere.

Efficiency

Heat pump efficiency is expressed as Coefficient of Performance (COP) which is a ratio of heat output to electricity input under specific testing conditions. For space heating applications, a more useful metric is Heating Season Performance Factor (HSPF). This number incorporates a wider range of conditions that better capture real world operation. Modern mini-split heat pumps offer HSPFs ranging from nine to 13 compared to less than nine for most central air-source heat pumps.

Heat pump technology is vital to the zero-energy movement because it is both highly efficient and versatile. Heat pumps can heat a home, cool a home, heat water, dehumidify air, and dry clothes with much greater efficiency than standard technology. For example, a heat pump water heater can make three units of hot water while consuming only one unit of electricity. By contrast, a natural gas-fired water heater makes between 0.60 (tank-style) and 0.95 (tankless) units of hot water for each unit of fuel burned. Not to mention, natural gas is a carbon-based fossil fuel. The electricity required to power an air-source source heat pump can be provided by renewable electricity generated on-site from solar panels on zero energy homes or purchased from a utility that obtains its electricity from renewable sources.

Renewable energy already contributes a significant amount of power to the utility grid and the percentage increases each year. Combining renewable electricity with a variety of heat pump applications is a win for zero energy homes and for the climate. The future is electric. And it's exactly the kind of science-based magic we need.

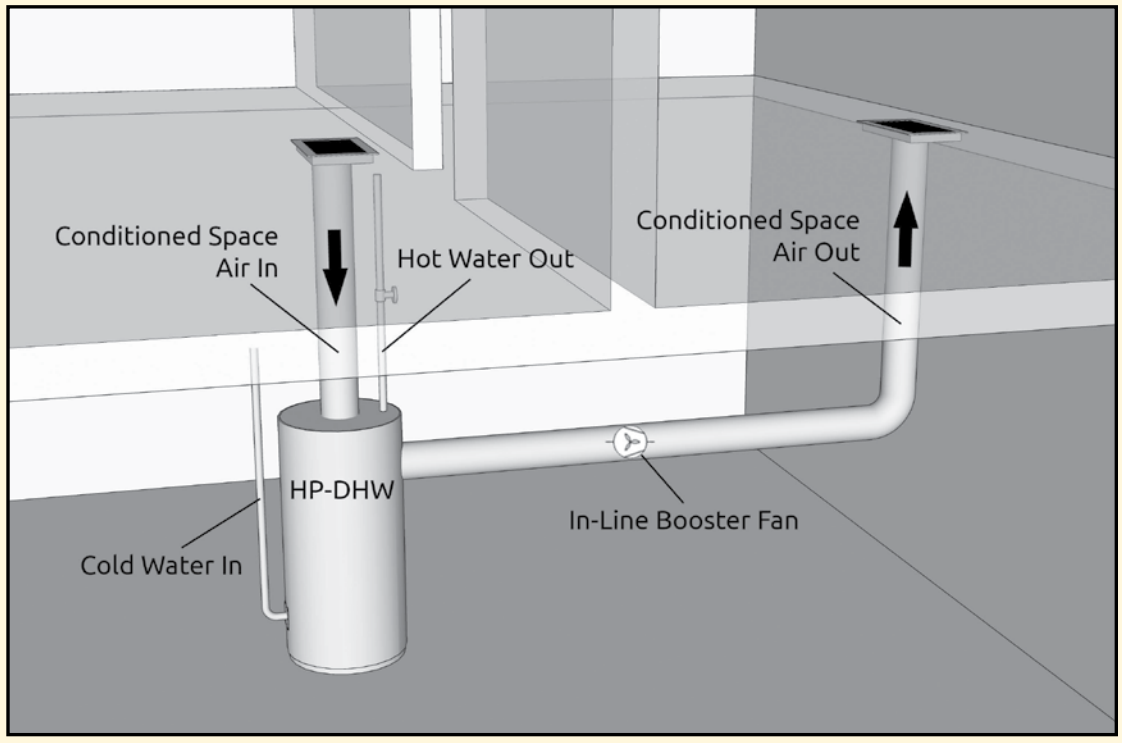
This piece originally appeared in Zero Energy Project's blog posted on April 13, 2020 at https://zeroenergyproject.org/2020/04/13/heat-pump-magic/.

Bruce Sullivan offers training to the construction industry and lives in a zero-energy home in Bend, Oregon. ♻

Heat Pump Domestic Hot Water A/C Hack

Jeff Rubin

You may know that heat pump (HP) technology has come to domestic hot water heaters (DHWs). Like all heat pumps, they use a refrigeration cycle to leverage latent ambient heat. This can result in half or even a quarter of the electric consumption used to create the same amount of hot water compared to traditional electric DHWs that use resistance coils. Unlike space heating heat pumps, whose performance is based on available outdoor heat, heat pump domestic hot water heaters (HP-DHWs) are designed to utilize the heat available inside your building.



Heat pump domestic hot water maker air conditioning hack. Image: sustainableheating.org

Is a HP-DHW right for you?

It's tempting; a HP-DHW will lower your annual hot water cost, which can be 15 to 18% of total home energy. That's the second biggest portion after space heating! HP-DHWs can be pricey, so some states offer rebates. (A list of states offering HP-DHW rebates and a DHW usage cost comparison tool is here, sustainableheating.org/heat_pump_domestic_hot_water_heater.)

As a rule of thumb, HP-DHWs require 700ft2 of airflow around the appliance in order for the heat pump to function effectively. Various manufacturers may have different specific space requirements. While DHWs are typically placed in basements where there is plenty of ambient air, they may also be placed in locations as small as a utility closet, so some manufacturers offer add-on kits to vent the HP-DHW's inlet and outlet ambient air to a larger room. Further on, I will explain how to hack those vent kits for air conditioning, but first, let's set some general expectations. Different homes have different basement layouts, basement uses, and hot water consumption patterns.

These things matter. Here is why:

While the HP-DHW is using the available heat in your basement air, it is blowing out air that is 25 to 30°F below the basement's ambient temperature. Think about your basement activities and whether they're seasonal. What are the factors that influence temperature in your basement? Do you have any heat emitters down there or is winter heat a function of heat loss from the boiler, ductwork, and hydronic heating runs? How much cool air the HP-DHW generates will depend on your hot water use, the appliance's recovery time, and the user-selected operating mode.

HP-DHW operating modes

Specific HP-DHW operating modes differ between manufacturers and models, but they are usually some version of the following.

Heat Pump

Heat pump mode utilizes the refrigeration cycle exclusively. The electric resistance elements will not come on at all. This is the most energy efficient mode and also requires the longest hot water recovery time.

Hybrid

Hybrid mode prioritizes the heat pump refrigeration cycle and uses the electric resistance elements as little as possible.

High Demand

This mode uses heat pump and electric resistance elements simultaneously. This results in the quickest recovery time while still providing some energy savings.

Electric

In this mode, the electric resistance elements do all the work. This results in the highest energy consumption. Electric mode is useful during heat pump maintenance and can also be used if the cooling effect or noise of the heat pump is unwanted as long as utility cost is not an issue.

Vacation

Instead of turning off your hot water and returning home to a cold shower, the vacation setting allows you to set the HP-DHW to get up to temperature the day before you get home.

Other considerations

- Traditional stand-alone hot water makers are silent. HP-DHWs sound similar to a refrigerator.
- HP-DHWs require a drain for condensate. If they cannot be gravity-drained to a floor drain, a condensate pump will be required.
- The amount of dehumidification will be based on the appliance runtime and other factors. The dehumidification performance cannot be specifically set.

Now, about that air conditioning hack

In order to get around the 700ft2 airflow requirement for DHWs located in a utility closet, some HP-DHW manufacturers offer an add-on kit which allows you to attach ductwork to the inlet and outlet ambient air vents. Instead of operating with basement air, you draw clean air from conditioned spaces and blow cool, clean, dehumidified air back into living spaces. The fan inside a HP-DHW is not intended to push air through duct runs, so this hack requires the addition of an in-line booster fan and an electric outlet to power it.

In my personal experience, with two people living in a 2,000ft2 building, this provides some modest air conditioning and significant dehumidifying. On hot, humid summer days, this keeps the downstairs comfortable, but we still use air-conditioning in the upstairs bedrooms at night.

Winter operation (no air-conditioning)

In the winter time, we either unhook the ductwork so that the HP-DHW uses basement air, or we just turn it off and switch over to the old indirect hot water maker. We could also use the HP-DHW in electric mode, although this would increase our electric bill from about $15 per month to almost $50.

I have also seen people hack their way into bringing more hot air around the HP-DHW by placing the appliance near a commercial-grade refrigerator with a compressor that pumps out a lot more heat than consumer units. Another strategy is to locate the HP-DHW near the ambient heat from the boiler or furnace, or figure out some other creative, site-specific heat reclamation strategy.

Thinking through your HP-DHW project

There is no one-size-fits-all answer. Adding any hot water maker requires a plumbing and heating professional. That said, there's plenty you can do to plan the project. Think through placement and position of the tank to minimize duct bends, hot water runs, and condensate drainage while still allowing access to HP-DHW controls. If you're handy, you may be able to self-install the flexible duct runs, in-line fan, floor penetrations, and registers.

We are at a moment in time when new HP-DHW technologies enable us to reduce our energy consumption. Understanding our options and applying them creatively allows us to save money and reduce pollution.

Jeff Rubin is Executive Director at Sustainable Heating Outreach and Education*, a nonprofit 501(c)(3) organization. For more information, go to: sustainableheating.org.* ♻

Time to Round Up Round Up

Jessie Haas

Herbicide path: Image: www.corporateeurope.com. Inset: Stop Glyphosate: www.pressenza.com

In January, the Manchester Vermont Conservation Commission (MCC) voted to support a bill creating a statewide ban on glyphosate. H.301 is sponsored by Representative Mari Cordes (D-Addison 4).

In a letter to the Manchester Journal, the conservation commission noted that 9.4 million tons of glyphosate, better known as Round Up, have been used to date, a half-pound for every cultivated acre on earth. Glyphosate, the active ingredient, has long been touted as safe and non-persistent in the environment. However, the scale of this experiment is unprecedented, and as usage increases, new effects are being found. Effects on soil micro-organisms are particularly disturbing, as scientists comes to a deeper understanding of how crucial these minute forms of life are to our climate, eco-system, and food supplies. There are also concerns about glyphosate's effect on the gut micro-biomes of humans and honey bees. A new study conducted by University of California Davis Comprehensive Cancer Center and Chiba University Center for Forensic Mental Health in Japan showed that in rats, exposure to glyphosate during pregnancy and lactation caused autism-like behavior and abnormal gut biota in male offspring.

Use of glyphosate is part of a chemical-agricultural complex that has been consolidated under the ownership of chemical and now pharmaceutical giants. Bayer now owns Monsanto, the developer of Round Up. Bayer stock dropped 47% after it acquired Monsanto, largely due to liability concerns triggered by losses of three lawsuits alleging that Round Up had caused non-Hodgkins lymphoma in users. Bayer recently agreed to a $39.5 million settlement of a large number of these cases.

Problems are even greater for farmers, who face difficulties with seed accessibility, cost, and the inevitable super-weeds, which have developed resistance to glyphosate and now require treatment with increasingly complex cocktails of chemicals. As the MCC notes, "a growing number of independent studies in the U.S. and Europe show significant correlation between glyphosate and glyphosate-based formulations and major health and environmental dangers." Formulations with added ingredients seem to be more hazardous.

Glyphosate's safety selling points were that it did not persist or accumulate in soil, and that it worked through a nutrient pathway that exists only in plants, not in vertebrates or insects. Both ideas are being called into question. Glyphosate has been found to persist in soils between two and 900 days. It kills certain beneficial soil organisms, rendering soil dry, compacted, and subject to erosion. As long as it persists in soil, it is subject to leaching into groundwater, streams, and rivers. A neuro-disruptor, it has been shown to cause behavioral changes in mosquito larvae that make them less likely to survive, and to make bees more vulnerable to pathogens. Both types of insects are a vital base of the food chain.

Use of glyphosate has increased with the move toward no-till agriculture. No-till has the potential to decrease soil degradation, increase photosynthesis, and shift the carbon cycle back toward balance. But the unknown effects on algae, larvae, the gut micro-biome of bees and mammals, and on soil micro-organisms may be too high a price to pay.

There's another way. Regenerative agriculture is a movement of farmers and advocates working to restore soil health and rural prosperity. One organization supporting the health of both the food chain and the farm community is Farmer's Footprint, founded by Dr. Zach Bush. Studio Hill Farm in Shaftsbury, Vermont works with Farmer's Footprint and with the Savory Institute. This 270-acre farm stopped using chemicals cold-turkey and experienced 2-1/2 years of failure. The soil was so depleted that it was absolutely dependent on chemical fertilizer inputs. The Studio Hill team brought in chickens, turkeys, and sheep. According to Studio Hill Farm's website, "In a few seasons the hay bale count was back up to where it had been under conventional management, but the grass was greener, leafier, and more nutritious than ever before." First the soil micro-organisms returned, then worms, birds, foxes, wild turkeys, deer, and coyotes. The farmers now dream of building a system of rural and urban food hubs, linking certified regenerative food from local farms with bigger markets through a network of electric trucks.

This type of transition is not simple, and it's certainly disruptive. However, the pandemic may offer a (heavily) disguised opportunity. Things are already disrupted. Commodity farming is already in crisis. With organizations like Farmers Footprint ready to help and people newly appreciative of the importance of locally grown, healthful food, this could be a good time to make the switch.

Links available on GET's website.

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

Sustainable Summer Activities – Cont'd from p.1

National Forest. The forest includes Mount Washington and many hiking trails within this region. Vermont's Green Mountains and the Adirondacks in New York are similar examples in our region that have small communities that are relatively free of Covid-19 but will have large numbers of visitors from places with far higher rates of infection.

Image: Flickr/SURFit

In a typical summer season, the economies of these areas are bolstered with visitors from nearby states. They normally rely on the economic benefits from the visitors.

This year is different. While the economy is suffering, summer tourism is definitely a controversial topic. Our regions in VT, NH and northern NY have had far fewer cases of the virus than many parts of the country. Even a few asymptomatic carriers could easily spread the virus and cause a huge increase of this viral activity in our rural communities.

Dr. Antonia Altomare, an infectious disease and international health specialist at Dartmouth-Hitchcock Medical Center in Lebanon, NH said, "We've been a little worried about an influx of people from out of state because in this particular instance, the prevalence [of COVID-19 infections] has been much greater outside of our borders."

Rules of engagement

Is it possible for people from outside our region, or even for those of us who live here, to engage in recreation and do it safely while minimizing exposure to our rural communities? We have new rules to think about with the Covid-19 virus and the need to stay safe.

Safety requires careful thought and preparation. Consider day trips, social distancing on trails, and possibly avoiding restaurants. Then think about how to handle gas station fill-ups in rural towns. What if you need a rest room or automotive repair if you break down? And what if you twist an ankle or suffer heat exhaustion or get bitten by a tick or have an allergic reaction to a bug bite or bee sting while hiking? All of these things mean more exposure to many others beyond our normal circle of safety during the pandemic.

Non-essential visitors can stress a rural region's limited healthcare infrastructure and resources, whether it be the grocery store, the gas station, or the EMS system, to name a few.

This summer, if you do come to visit or are recreating locally, make sure to have and wear a face mask and use sanitizer often and wash your hands! Try to limit your extra stops to those most needed. Pack your lunch and dinner, perhaps. Let's enjoy our summer of 2020 and make it a safe and a positively memorable experience for all of us long after Covid-19!

N.R. Mallery is the publisher of Green Energy Times. ♻

The E-bike Solution

Cont'd from p.4

"sweet spot" of affordability.

"That was cool – actually that was one of the incentives you know in terms of doing this now," commented Welch, a sentiment shared by Wynkoop who said," I think it's wonderful that they are promoting that."

With the arrival of COVID-19, bike sales in Vermont and throughout the nation have increased to the point that many retailers have witnessed record sales in May. One said, "Last month my sales were more than double my best month in thirty years." Another stated, "In early April, we just started seeing this massive increase in business. New riders, new customers, people wanting to get their ten or twenty-year-old bike serviced, or an e-bike. And there are long term rentals to people escaping cities, people quarantining in place up here."

For its part, Hanover Adventure Tours has barely opened its doors and is experiencing brisk business.

Though many of the sales of e-bikes have been to folks looking for an easier and more leisurely cycling experience, sales of higher-end e-bikes to people wanting to ride farther and more aggressively have also increased to the point that one shop that sells road bikes, gravel bikes, mountain bikes, and hybrids (also called fitness bikes) reported that e-bikes now account for about 40% of sales.

And with the ever-increasing popularity of fat-biking (bikes with very wide tires) in winter, several manufacturers are offering electric-assisted fat bikes.

Homeier said, "Even avid cyclists are finding that e-bikes take them further. It's been game-changing."

HAT is dedicated solely to e-bikes and carries the Magnum and Yamaha lines that offer a wide array of bikes suitable for commuting, recreational riding, or even commercial delivery applications.

The Magnum Peak, a front-suspension hard-tail with a 500-watt geared-hub motor, or a similarly equipped Yamaha bike will take on the class four and five roads and single tracks with the best of them.

HAT carries e-bikes of class 1 (bikes requiring pedal assistance without throttle and having a speed of up to 20 mph), class 2 (bikes with both pedal assist and a throttle limited to 20 mph), and class 3 (bikes with pedal assist and a throttle and a maximum speed of 28 mph.). Of course, the maximum speeds listed can be exceeded if you pedal hard or are going downhill, and so we hesitate to say that speed is limited, but the fun certainly is not, even when used for errands or going to work! ♻

Bogotá Company Deploys 400 Free E-Bikes to Help Health Workers Respond to COVID-19.MUVO CEO Daniel Otero and COO Miguel Ocampo with health workers who are now using the company's e-bikes to get around Bogotá. Photo by MUVO.

Greening Up Regional Golf Courses with Solar and more

Roger Lohr

Golfing is among the favorite warm-weather recreational options with more than 24 million golfers in the U.S. and another 9.9 million who use driving ranges or indoor golf simulators. The golf industry estimates that there are 108 million people that play, watch or read about golf. In the U.S., there are about 16,300 golf courses at 14,300 golf facilities with 75% of them opened to the public. Opportunities for golf course superintendents to apply sustainable operations at golf courses are many.

Owner, Joseph Videtta of Laurel Lanes Country Club takes pride in their 100% solar-powered status along with many other environmental practices. Photo courtesy of Joseph Videtta.

Featured in Golf Course Industry magazine, the Laurel Lane Country Club in West Kingston, Rhode Island claims to be the only golf club that is totally solar powered in New England. The cost of running the irrigation system, facility lighting and all of their electrical needs are offset on electric bills by the solar system.

This 146.16-kW solar system at Laurel Lanes is a net-zero project that wipes out their entire electric utility bill. AllEarth Renewables (AER) supplied the 14 dual-axis trackers to E2Sol, LLC, located in RI. The system consists of 336 SunPower 435W modules and ABB inverters, which add up to the country club being 100% solar powered since 2016. Anthony Baro, Managing Principal at E2SOL LLC (www.E2SOL.com) said that this solar project received a cash grant incentive from Commerce RI and received 100% financing from the C-PACE program.

The owner of Laurel Lanes, Joseph Videtta, proudly said "every month we produce more electricity than we use. I love it. We have 180 acres. We love the environment. We also keep open spaces throughout the country club natural for milkweed to grow and purple Martin's to nest. Together we are making the world a better place."

Videtta is also the owner of two other golf clubs in Rhode Island. One of them will be going 100% solar-powered later this year. Solar sustainability in RI does not end here. Joe's successful example set the stage for his friend who owns Cranston Country Club in RI. They will soon be 100% solar-powered with a similar system as Laurel Lanes. They will be breaking ground in July to become net-zero energy in 2020.

Electric golf carts are another option that can become popular as these vehicles save energy, are quieter than gas-powered carts, and have no exhaust. Electric carts such as MOTO Electric Vehicles cost less to run and maintain (no oil changes or tune ups required), but they may require recharging and access to electricity if used more than a few hours. Electric golf carts start at $5000 and gas cart prices begin at $4,000, but there are options that go to $15,000.

Other sustainable operational areas for golf course operations include the energy and water conservation associated with irrigation. The cost of course maintenance such as lawn mowing and the use of fertilizer and pesticides are expensive aspects of the operation that can incorporate environmentally-sensitive practices to reduce the course's environmental footprint. Some of the suggestions provided in Making Your Golf Course Greener: A Handbook for Golf Course Managers prepared by Christopher Moore for the NH Department of Environmental Services are low or no cost while others are more involved. The process of becoming a more sustainable business is a continuous endeavor and golf courses are in a constant process of increasing efficiencies, reducing their generation of waste and reducing operating costs and liabilities.

Roger Lohr is the recreational editor for Green Energy Times *and owner of XCSkiResorts.com.* ♻

A New Pathway to Nature and Golf

Reprinted with permission from the Arbor Day Foundation: Newsletter: March/April 2020

A 1.2-mile footpath connects Lied Lodge to ArborLinks Golf Course. Photos courtesy of Arbor Day Foundation.

Nature and golf may seem incongruous, but at Arbor Day Farm a way has been found to link the two for the benefit of all. Last fall, a new, innovative trail was completed that connects Lied Lodge and Conference Center to ArborLinks Golf Course located in Nebraska City, Nebraska. The 1.2-mile footpath has been named the Conservation Trail and takes guests past demonstration areas such as the hazelnut research area, alley cropping, the fuelwood forest, a gorgeous clonal-walnut grove, heirloom apple trees, the preservation orchard, and other educational sites.

The trail meanders over the natural lay of the land and is constructed with a material that uses native soil mixed with a small portion of concrete and water, which is rolled smooth. It makes the trail broadly accessible, while its natural color blends nicely with the surroundings. "It opens up the farm to more guests," says Austin Mackrill, vice president of Arbor Day Farm. "It's like opening new chapters in a book. The trail connects two world-class properties in a natural way."

Austin also reports that guests have already told him it is their favorite trail. And it's no wonder. As the trail winds its way along the edge of woodlands, fields and farmland, visitors often spot wildlife such as deer, raccoons, opossums, wild turkeys, and an amazing variety of other songbirds.

The trail ends at ArborLinks, a 300-acre, award-winning golf course privately owned by the Dormie Network. Guests at Lied Lodge have golfing privileges at the course and can even arrange to use an electric golf cart along the trail to go to and from the course. This partnership with the Arbor Day Foundation offers yet another educational opportunity. The Arnold Palmer Signature course showcases the site's natural landscape and incorporates environmentally friendly practices such as the use of native grasses and trees, bioengineered creek banks, wildlife habitat protections, and other features that have helped make it one of Nebraska's top ten golf courses and the country's first conservation-designed course.

Austin invites visitors to hike, bike, or walk to explore the new trail. He says, "It connects our guests to nature and broadens their outdoor experiences. This has the power to enhance each individual's quality of life and connect him or her to the Arbor Day Foundation's mission, which is having a global impact in so many ways." ♻

PHASE-OUT FOSSIL-FUEL FINANCING

Dr. Alan K. Betts

This year I am searching for solutions to the climate and extinction crises, because time has run out. As society is focused on the COVID-19 crisis, the federal government is using this as a cover to cut environmental protection for clean air and water, and attack automobile emission standards. Business and financial interests are very unhappy that the collapse of the global economy has cut carbon emissions and air pollution so substantially. However, this benefits the Earth and the climate system, as well as human health and the human spirit. For the first time in thirty years, people in the northern Punjab in India can see the glorious Himalayan mountain range 120 miles to the north.

Let us ask: what are the leverage points in our society to reduce fossil fuel use?

Bill McKibben pointed out the key role of finance in a New York Times article last fall titled, "Money is the Oxygen on Which the Fire of Global Warming Burns." He listed the key pressure points: banking, asset management and insurance, so let us examine these.

JP Morgan Chase has been the leading US bank investing in new fossil fuel development. Their CEO talks soothingly about "improving capitalism to create a healthier society with affordable health care and better climate policies" (Time, 2/3/2020). Recently, they declared they would stop providing loans for new oil and gas drilling projects in the Arctic. Goldman Sachs made a similar announcement in December. Other banks should be pressured to follow suit. The Republican governor of Alaska is angry at both banks, and his budget calls for $254 million in new tax credit payments to oil and gas drillers. Clearly Alaska's governor intends to sacrifice our children for money.

BlackRock is the world's largest asset manager, and also the world's largest investor in coal companies, coal-fired utilities, oil and gas companies, and companies driving deforestation. Recently they have indicated they will start some limited thermal coal divestment, since it is not profitable. Their web-site made this claim: "Our purpose is to help more and more people experience financial well-being. In pursuit of this, a focus on long-term sustainability is embedded across our business. From integrating environmental, social and governance practices into our investment processes, to creating positive social impact by serving the communities in which we operate, we are dedicated to helping clients, employees, shareholders and communities achieve long-term, financial well-being." This is Orwellian doublespeak at its most tragic; since while they are diligently making money off fossil fuels, they are ensuring the destruction of the planet. This will bankrupt their clients, and make long-term sustainability a farce.

Protest at the Legislative Building in Olympia, Washington. Ted Nation, an activist for several decades, sits beside the protest sign. Image: Wikipedia Commons.

The insurance industry is the third group that routinely invests enormous sums in the fossil fuel industry, since no one can build or operate a facility without insurance. Ironically, the insurance industry understands the risks, and they have the data to know how bad the climate crisis is. The last decade was the costliest on record; with economic costs from natural disasters of over $3 trillion. This is tiny compared with the hundreds of trillions in costs that lie ahead.

All these large financial sectors understand the climate and extinction crises, and they know that by profiting from the fossil fuel industry, they are complicit in a crime against our children and against the Earth. It is time to stop them, using whatever tactics and shaming strategies we can invent, including non-violent civil disobedience, as proposed by Extinction Rebellion. We need disinvestment everywhere from the fossil fuel industry, with growing carbon taxes both to drive the transition off fossil fuels, and to fund the huge investment needed in efficiency measures and the transition to renewables.

The financial system oppresses the poor and exploits the Earth, which is clearly unjust. We need deep change and that means struggle. A remarkable speech by Frederick Douglass is as true today as in 1857, when he was recognizing the black Baptist minister, Samuel Sharpe, who called 60,000 slaves in Jamaica out on strike for half pay on Christmas Day in 1831. Although Sharpe was tried and executed for treason, his moral stand led directly to the freeing of all the slaves across the British Empire.

"Power concedes nothing without a demand. It never did and it never will. Find out just what any people will quietly submit to and you have found out the exact measure of injustice and wrong which will be imposed upon them, and these will continue till they are resisted."

This is why our communities need to get together to demand a just financial structure for capitalism that is not based on fossil fuels and does not exploit the poor. For thirty years we have avoided facing this, as the climate and extinction crises have accelerated. Our politicians have accepted being bribed, and the people have quietly submitted to debt, consumerism and isolation.

But we must change - or lose a livable Earth. Capitalism was built on burning fossil fuels, but the increasing greenhouse gases are driving a global energy imbalance that is stored in the oceans for centuries. Catastrophic climate change is coming in the next few decades that will overwhelm our entire economic system, unless we change its direction now. Make no mistake, the Earth is far more complex and powerful than our technology, and climate change is one way it can strike back.

New England had an exceptionally warm winter, when for the first time our garden soil in Vermont stayed unfrozen. In every month, January, February and March, my grandchildren and I were able to dig under the rye cover crop, or the soil mulched with two inches of leaf mold. Spinach and lettuce flourished under glass for harvest in April. As global supply chains crumble with COVID, it is essential we think about resilience, and re-localize our food supply as well as our industry.

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

Blockchain Systems and the Distributed Sourcing of Power

J.D. Kaplan

With so many things strained in supply, it might feel like a luxury to have anything abundant at all. Information pumps, however, still seem to be working at full capacity. Drowning in spreadsheets and news bites, some way to find certainty in the data one depends upon would naturally float to the top of the value heap. That is, to be certain what you're looking at matches what your bank or your colleague put in at the other end, is suddenly golden. Thus, a technique or technology that attests to its veracity might itself be of as much value as the thing being accounted for.

Such is the profile story of Bitcoin and the Blockchain that it came from.

Just before the wave of lockdowns reached the U.S., I had the pleasure of representing G.E.T. at the Solar & Storage energy conference held in Boston. The complexity of energy exchange, and the concomitant fiscal mess behind it, came to light through this experience for me. There can be financially independent operators for any physical component of an electric grid, from the power plant all the way down to the "service drop," the line connecting to your house. In my area, this means that when the power goes out, there could be as many as four parties involved as it has to be restored.

Image: geobrava.wordpress.com

So, to imagine a power grid with almost as many power producers as there are roofs big enough for a solar array might be tough enough. To build one that is equitable and fiscally transparent might seem out of reach. The running answer, as it were, is the blockchain.

To explain why blockchains, a core technology underneath Bitcoin and all cryptocurrencies, offer such validity and transparency to green energy and the democratization of electricity, we can look to the work of Andoni et al: "Blockchains can securely record ownership and origins of the energy consumed or supplied." Dr. Andoni[1] and her team track around 140 independent projects within the energy sector around the world that have sparked around this central theme. All handle the various units of account we're concerned with in the energy field, exchanging carbon, coal, and kilowatt-hours.

Block-chains first emerged in 1991, when two mathematicians named Haber and Stornetta published a paper[2] advancing a method of verifying data. They were witnessing the world of important records being digitized in a hurry, and saw this as a problem. Their logic allowed a group of transactions to be fingerprinted—the block—and then chained together, so that an observer with no forensic tools can easily see whether or not any transactions in the record had changed. If a single item is altered anywhere in any block, the fingerprint, a math result they co-developed, will appear completely different. Thus, if you chain your blocks together—think of many months of entries to your checking account—and someone alters a bit from six months ago or six years, even the most recent fingerprint would change.

You would then be tipped off to tampering. This simple concept is the essential point of the work that has brought around 250 billion USD in value to digital currencies to date. It is also the core technique that so many progenitors of a smart grid, microgrid, power aggregators and community energy exchanges of all types have begun looking toward to. This could keep these things equitable, accountable and easily auditable.

If we expect a green future, the distributed sourcing of power is likely to be a pillar of its structure, with the use of blockchain systems at root.

Links:
[1] https://bit.ly/36wL30j M. Andoni, et al
[2] https://bit.ly/2ZI9Ehr Haber & Stornetta

J. D. Kaplan is a certified remote pilot and a former member of the I.T. crowd. He is a reader in the areas of bioelectromagnetics and cryptocurrency. For G.E.T. readers, Mr. Kaplan intends to profile blockchain activity within the energy sector. He lives and works at or above sea level near Boston, MA. ♻

Coronavirus Bails Out the Oil Patch

THE FIX IS IN FOR POLITICALLY-FAVORED OIL, GAS AND COAL COMPANIES

Carl Pope

The huge financial aid package enacted by Congress this spring entailed a sprawling array of programs to direct funding, guarantee loans, relieve debt and more to support businesses laid low by a global pandemic. It also opened the door to a money grab. As a result, hundreds of millions of dollars are likely to end up in the pockets of oil and coal investors and executives in what may be the biggest campaign donor payoff in U.S. history.

Failing oil and coal companies quickly moved to exploit the bailout as a financial lifeline. They had help. Seventeen Republican senators sent a letter in April to the Federal Reserve, effectively urging the use of coronavirus rescue funds to bail out bad coal and oil debt.

In a separate letter to President Donald Trump, a group of three dozen senators and representatives argued that banks should be punished for "discriminating against America's energy sector" by denying financing to sinking fossil fuel companies. Conservatives have long demanded that the market should decide such matters. But the oil patch plays by different political rules.

Funneling taxpayer funds to failing companies in a declining industry that wreaks trillions of dollars in damage on the environment is not an easily justified investment. Yet the Federal Reserve, which sets loan guidelines for some of the rescue package, changed the rules of its "Main Street" lending program to allow companies to use taxpayer loans to pay off existing debt instead of retaining workers.

Under pressure from Republicans, the Federal Reserve also increased the maximum loan amount in the Main Street program to $200 million. At the same time, the rules were tweaked so that credit ratings could be ignored. A separate bond buyback plan could end up bailing out 90 fossil fuel producers along with 150 electric utilities that have financial exposure to the sector, according to one analysis.

In addition, a small business assistance program intended for mom-and-pop companies was raided early by coal and oil companies, which collected a combined $50 million. Three of the bailed-out companies have employed executives who have worked in the Trump Administration, including the scandal-tarred former Environmental Protection Agency administrator Scott Pruitt.

California oil pumps. Does the oil industry need a bailout? Photo: CGP Grey, Wikimedia Commons, https://bit.ly/3fwCQwu.

When Democrats in Congress complained about public subsidy of environmental degradation and business failure, the Fed insisted that its program changes were not targeted to help coal, oil and gas companies. However, oil-state senators and Secretary of Energy Dan Brouillette couldn't help bragging that the goal was exactly that.

The largesse has little to do with preserving jobs. Coal and oil companies had already begun large-scale layoffs, and they will not bring those workers back no matter how much money the government showers on them. The reason is elementary: the market wants less of their product. Some shale-oil drillers are paying to have oil taken off their hands because they have no place to store it. The rig count in the Permian Basin, around West Texas, fell by 50% in the past five weeks. As new wells are completed, employment will fall further.

The decline in fossil energy long preceded Covid-19. Most of the nation's coal companies had been through at least one bankruptcy. Shale oil producers lost a collective $189 billion over the past decade. In 10 of the last 11 years the oil industry was the largest issuer of junk bonds.

The rationale behind the giveaways to favored oil, coal and gas interests is not economic, it is simple smash-and-grab. According to Bloomberg News, Diamond Offshore Drilling Inc. obtained a $9.7 million tax refund through the rescue package. Then, it turned around and requested that a bankruptcy judge authorize that same amount in bonuses for nine executives.

Republicans intend to redirect hundreds of millions from American workers into the pockets of investors who made bad bets on failing oil and coal companies. The source of the oil slick is in the swamp.

Links available on our website posting of this article.

To learn more about Pope's views on the environment, energy and climate, read Climate of Hope, which he has co-authored with former NYC Mayor Mike Bloomberg. The link is https://www.climateofhope.com.

A veteran leader in the environmental movement, Carl Pope is the former executive director and chairman of the Sierra Club. He's now the principal advisor at Inside Straight Strategies, looking for the underlying economics that link sustainability and economic development. Pope serves as a Senior Climate Advisor to former NYC Mayor Michael Bloomberg. He has served on the Boards of the California League of Conservation Voters, Public Voice, National Clean Air Coalition, California Common Cause, Public Interest Economics Inc, and Zero Population Growth. ♻

A Green New Market

Cont'd from p.3

could become customers of all sorts of green new American products. This is particularly important because these same people are being given some pretty good deals from China right now. (China has a history of loaning money to poor nations so they can buy Chinese products. Even the terms for default are easy. When Sri Lanka defaulted on a loan, all it lost was a few acres of land in a port that China could use for a navy base.)

The people who would get our kits are also people who may not love America, except as a potential destination for emigration. Do you care about America being overwhelmed by immigrants? Give them a reason to be happy where they live. Not only might that work a lot better than a wall, it might actually make us money, as we sell them products.

Do you care about America building good will? It could build a lot of good will if 220 million families watch television or run computers that are powered by home generating systems with American flags on them. And yes, a $1,000 solar system could power a computer and a television, both at the same time, if they are chosen with reasonable care.

After an earthquake in Nepal, a small solar panel is so much better than nothing at all. Photo: mohigan, Wikimedia Commons. https://bit.ly/30VBo2m.

Conservatives would have to accept the possibility of climate change, if they are to buy into the Green New Deal, of course. But I think they will accept climate change if they look at it objectively.

Climate change represents what may be the biggest business opportunity ever to be presented to humanity. And it is not just that we have to stop climate change; the business reasons to do so are overwhelming.

The fossil fuels sectors were losing money before the pandemic struck, because they were obsolete and the market was already turning away from them. With low-cost renewable power, fossil fuels were already too expensive, and the costs of renewables just keep falling. Continued investment in fossil fuels just builds up stranded assets.

If we act now to push renewables in America, we can be on the bandwagon of countries profiting from the change. If we act quickly, we will be able to drive the bandwagon. If we continue to act as we are, however, America will eat the bandwagon's dust.

If Republicans get behind the Green New Deal, even if only to get access to the coming Green New Market, my guess is that Democrats will not mind. If some people get needlessly, possibly even mind-bogglingly, wealthy, Democrats might not care, as long as people who need it are getting help.

The political willpower needed to do this is only difficult because fossil fuels would not survive in a Green New Market. Climate naysayers are well-funded, but with a goal to preserve fossil fuels, not to make America great again.

We can make America great again, but only if we ditch fossil fuels. ♻

The Great Indoors: Creating a More Healthful and Safer Built Environment

Multiple Contributors from Steven Winter Associates

With the spread of COVID-19 has come widespread quarantine, work-from-home policies and increased time indoors, making it all the more important that we think about the air we're breathing and the surfaces we're touching. With certain building and design considerations, we can make these impacts beneficial.

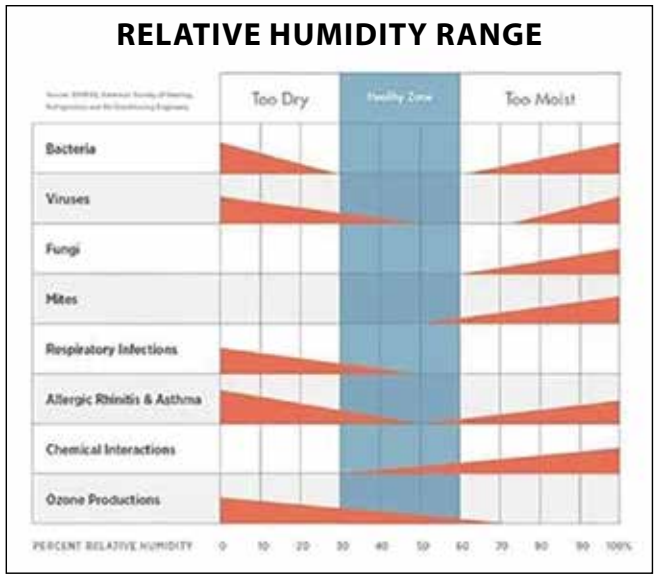
Here's some timely information from Steven Winter Associates'(SWA) experts on the considerations ensuring the health and comfort of a building, and on the certifications that assure these considerations are met.

Filtration and Ventilation

One of the keys to a healthful living environment is high quality indoor air achieved through ventilation.

Simply put, ventilation removes contaminants that accumulate in the indoor air and replaces it with outdoor air that is not contaminated. There are several ways to ventilate. Most buildings have exhaust-only ventilation systems, characterized by local mechanical exhaust fans, operated intermittently, which typically remove air from the kitchen or bathroom. Replacement air is pulled into the living environment from an adjacent corridor, an open window, or your neighbor's apartment. It might be pulled through the wall assembly, the crawl space, a crack in the foundation, or some combination of the above. And, who knows where that air has been?

There is a better way. Continuous balanced ventilation systems, combined with air sealing and compartmentalization, provide more control over the air we breathe. Air is constantly exhausted from the kitchen and bathroom at low volumes and is replaced with air from a known origin via a dedicated outdoor air duct. The living environment is pressure-balanced – there's an equal volume of supply air and exhaust air. Our air is no longer being pulled from parts unknown. Balanced ventilation systems operate best with the installation of a continuous air barrier system in exterior wall assemblies, and compartmentalization measures between apartments, decreasing the amount of air that is pulled from adjacent apartments and through wall assemblies. Additional benefits include decreasing transmission of odor, smoke, sound, and pests. With a continuous balanced ventilation system, and the appropriate compartmentalization and air sealing measures, we know the origin of our breathing air.



Humidity

Thermal comfort – favorable temperature and humidity conditions – is fundamental to the proper functioning of any occupied space and wellness. Indoor environments that are too warm may lead to sick building syndrome resulting in occupants' negative moods, increased heart rate, respiratory symptoms, and feelings of fatigue. Relative humidity below 20% can cause dry eyes, skin, and mucous membranes. High relative humidity (above 70%) may lead to stuffiness or mold and fungus growth, which produce allergens, irritants, and in some cases, potentially toxic substances (mycotoxins). Regular inspections of roofing, plumbing, ceilings and HVAC equipment will identify possible sources of moisture and potential condensation, which should be immediately addressed.

Of interest now, viruses survive for longer periods at low humidity, so it is even more important to maintain relative humidity between 40% and 60%.

Building Materials

The current pandemic brings us a renewed awareness of the materials in our environments. Thoughtful and responsible choices can help increase our health and wellness as our living spaces become full-time work, education and play spaces.

There are choices for current and future buildings. Think about cleanability. How easy or difficult is it to disinfect a given material with soap and water or disinfectant? ("Green" cleaning protocols would not ordinarily include bleach or chemicals.) How many grout lines or other transition materials are used, how cleanable are those transitions, and can we choose materials that minimize those transitions? We expect to see a renewed focus on cleanable materials that will ultimately improve health and durability under ordinary circumstances (and extraordinary circumstances).

Keep on the look-out for a surge in antimicrobial finishes. Be careful with those, because while they are designed to kill or inhibit the growth of microorganisms, many antimicrobials contain triclosan and triclocarban, which have been shown to interfere with normal human development and function.

Cont'd on p.25

The Great Indoors

Cont'd from p.24

Another concept to consider is no-touch building finishes and amenities. In a post-COVID-19 world, choosing touchless automatic door openers and elevator buttons, more lighting occupancy sensors, touchless water-bottle refill stations will be on the rise. Those touchscreens in the lobby or checkout counter will likely be a thing of the past. We hope that there will be a touchless handwashing station in every new building lobby!

A living rooftop design. Images courtesy of Steven Winter Associates.

Universal Design

The goals of Universal Design include incorporating health and wellness into the built environment. Many of the concerns targeted in health and wellness design strategies, such as chronic respiratory disease, diabetes, heart disease, and chronic illness, qualify as disabilities under the Americans with Disabilities Act (ADA). Further, each one of these health concerns is an underlying condition highlighted by the COVID-19 pandemic.

There are several shared goals and design strategies among health and Universal Design initiatives that not only serve to create healthier environments but can also contribute to better spaces for all building occupants.

Certifications

Knowing what to design and specify is the first step. Proper construction and installation are next. But to really ensure that buildings are constructed for health and wellness, the final step is certification. Here are a few programs.

WELL: Created by the International WELL Building Institute (IWBI), the WELL Building Certification Program is focused on human health, mental wellness, community engagement, and overall comfort and well-being.

The IWBI requires on-site performance testing verification by third-party testing agents to prove that the project's design and installed materials match the requirements as prescribed. On-going performance verification is required every three years.

Fitwel: The Center for Active Design oversees the Fitwel certification systems for healthy buildings and communities. Probably the most powerful and unique elements of the program are not the indoor air quality plans but the ways the program addresses the connection between physical inactivity and mental health. Fitwel includes daylight, views of nature, operable windows, a vegetable garden to plant, or acoustic comfort from exterior or interior background noise. For more ideas about what can you can do to make your current or future project a bit healthier, visit the Fitwel Resources page: https://www.fitwel.org/resources.

Indoor airPLUS: Created by the US EPA, Indoor airPLUS Construction Specifications require that a newly built home includes additional protections to address moisture control, radon resistance, pest prevention, improved HVAC systems, reduced combustion pollutants, and low-emission materials. As an added layer, all Indoor airPLUS homes must first earn ENERGY STAR certification, improving energy efficiency and comfort as well. For more information on this certification, visit the EPA website: https://www.epa.gov/indoorairplus/basic-information-about-indoor-airplus

Steven Winter Associates, Inc. provides research, consulting and advisory services to improve commercial, residential and multifamily built environments. They specialize in energy, sustainability and accessibility consulting as well as certification, research and development and compliance services. ♻

NEEDLESS DEATH IN THE SERVICE OF SELFISHNESS

John Bos

Many Americans have been under strict stay-at-home orders, or at least advisories, going on three months. People are, unsurprisingly, frustrated and depressed but have complied with what they've been asked to endure, because they trust the state and local public health officials are telling the truth about the coronavirus pandemic.

There has been passionate – and honest – argument about how many people are likely to get sick and die under different circumstances and sets of official rules. It's not clear how uncertain and continuing evolving scientific findings should affect extraordinary government measures that restrict citizens' basic freedoms.

Recently there have there been growing public protests against continuing the lockdown, the "reopen" movement. The people who are doing the demonstrating may really be frustrated and upset, but new research and journalistic investigation is revealing that there are powerful forces behind them, egging them on. This is not unlike those protesting the murder of George Floyd that, for the most part, are intended to be peaceful protests.

Dissent – and the freedom to do it – is a crucial element of democracy. Political leaders are rightly influenced by public opinion. But it's important to know when protests are sparked by special-interest groups seeking to manipulate official's understanding of public sentiment.

Looking not too far back, one can see that the questions about the current protests raise echoes of the Tea Party movement a decade ago. Marc Ambinder, Executive Fellow in Digital Security at the University of Southern California, Annenberg School of Communications and Journalism. wrote, "in mid-April 2020, it appeared that a new movement was rising to express frustration with the restrictions and uncertain endpoint to the pandemic and the economic toll the lockdown has caused."

"In the space of several days," he continued, "there were protests in a dozen states, ranging from a crowd of more than 2,000 who gathered in Olympia, Washington, to several dozen in Annapolis, Maryland."

"The available evidence suggests that the demonstrations were organized by paid political operatives using Facebook and brand-new websites," Ambinder wrote, "to encourage conservatives to protest in specific places against specific governors who had imposed strong public health restrictions on economic activity. This context indicates that one real intention of the protests was to create the illusion of an organic movement that had arisen to object to the restrictions. Evidence is to the contrary: Polling shows that just 12% of Americans think their local restrictions have gone too far – and 26% think they don't go far enough."

A "reopen" protester will argue that the government should get out of the way and allow anyone who wants to go back to work, or to the store, gym or swimming pool to do just that. Anyone who's afraid of getting COVID-19 can just stay home.

"Not Another Black Life" rally in Toronto. Taken May 30, 2020. Image: Flickr/Jason Hargrove.

"The reopen movement," Brian Kahn, Managing Editor of Earther writes, provides the cover for "politicians to ignore the science and popular will to enact shortsighted policies and throw up their hands when more people get sick and die. It also gives us a preview of how some people and leaders will respond to the steps necessary to address climate change which will require similar bold actions that will upend the status quo."

"The best available science," Kahn continues, "tells us drawing down emissions rapidly this decade is our best shot at protecting the climate and humanity. Even then, people will still die, and we should absolutely mourn that fact. But more than that, we should be mad as hell that fossil fuel companies and pliant politicians have made that the best-case scenario while also doing their damnedest to ensure we don't even get that."

That we must reopen the U.S. in the face of the coronavirus risks is as hollow as thinking we can do nothing about carbon emissions. The results will be the same: needless death in the service of selfishness. In the case of the climate crisis, that death will be so much more widespread, encompassing the entire biosphere that has made it possible for humanity to thrive. I would like to learn more about the paid political forces behind the climate denial "movement."

John Bos is a contributing writer to Green Energy Times *and* CitizenTruth.org. *He has written about his growing concerns about our endangered environment for the past ten years. Your comments and questions are invited at john01370@gmail.com.* ♻

Book Review - *TOUCHING THE JAGUAR*

by John Perkins, Berrett-Koehler Publishers, 240 pages

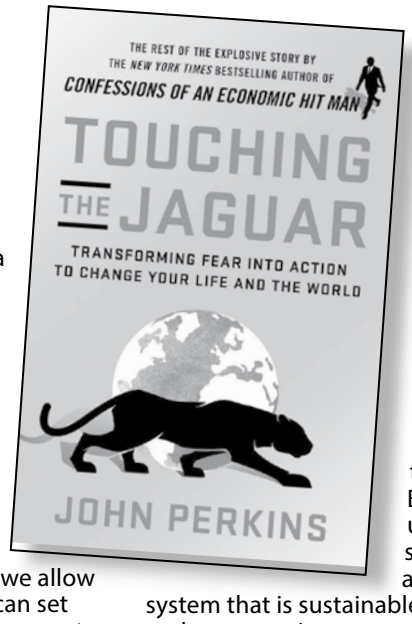
Review by Roger Lohr

The word "inspire" comes from being "in spirit" and the book Touching the Jaguar: Transforming Fear Into Action to Change Your Life and the World by John Perkins on Berrett-Koelher Publishers encourages that we rise to a better understanding of what it means to have and apply the power of human spirit on this planet.

Touching the Jaguar encompasses Perkins' decades-long sojourn around the world with his interest in shamanism and indigenous societies' fight against the efforts of oligarchs. In the words of an Ecuadorian indigenous man who lived in the rainforest, "Your oil companies have poisoned the rivers of our neighbors. They murder women and children with their poisons and kill our warriors who try to defend their lands. They drop fire from their planes. Your people have no respect for the forests and the rivers and the animals - when they come to a place, it turns to ash and black oily mud. The trees and animals vanish, never to return."

You might view their perspective as seeing the glass half empty but some indigenous people see "our" lifestyle as highly materialistic and they feel that "the unsustainable lives that the majority of us now lead are linked to a cultural evolution of crowded cities, pollution, extreme waste, and income inequality whereby we are seemingly destined to end in self-destruction."

The author introduced a group of potential NGO investors to the indigenous Amazon in Ecuador and a plan was hatched to create the NGO to empower indigenous people of the Amazon rainforest "to preserve lands and culture and educate/inspire people everywhere to bring forth a thriving, just and sustainable world – facilitating personal and global transformation to a life economy whereby a social-governmental-economic system would be developed to clean up pollution, regenerate devastated ecosystems, and develop new technologies to benefit people and nature."



In a conversation with a former Boston University professor, Perkins was told, "We're all guilty. We have to admit that although the big corporations own the propaganda machines, we allow ourselves to be duped. But you can set an example to show people the way out - redemption comes from confronting and changing it. Take action."

School textbooks in America cast us as defenders of democracy but it is our job to prepare the next generation for the challenges to come. Perhaps the current direction of teaching students' skills to think and apply what they learn is a better educational path. Perkins' challenge is that "either we change our ideas, values and actions, and accept new ways of relating to other people, resources, countries, governments and cultures OR we will propel ourselves into extinction." He asks if we are smart enough to stop shortsighted divisiveness and instead unite to protect our common territory – our living planet.

We possess abundant human and natural resources and the choice is to continue using those resources to maximize short-term materialistic gain regardless of environmental and social costs, leading to the "Death Economy," or to use those resources to create a "Life Economy" system that is sustainable, renewable, and regenerative.

Perkins outlines the key characteristics of the Death and Life Economies. The Death Economy goal is to maximize short-term profits, promoting the outlook that for someone to win, another must lose. It is predatory against humankind and the environment, valuing goods and services that are extractive and materialistic above those that enhance the quality of life. There are another dozen characteristics of this economy that Perkins goes on to discuss.

The Life Economy maximizes long-term benefits for people and the environment, serving public interest, cooperation, valuing the quality of life and spiritually enhancing activities. It includes externalities in financial and economic measurements while developing new regenerative sustainable technologies. The Life Economy is based on a foundational knowledge that humans are in a symbiotic relationship with the planet where we must respect, honor and protect the natural world.

Examples of Life Economy could include the Green New Deal, B Corporations, cooperatives, benefit corporations, organic farming programs, the long-term stock exchange, and so on. In August 2019 there was a Business Roundtable held with 192 corporate CEOs promising to abandon the goal of maximized profits for shareholders above all else, and instead commit to balancing the needs of shareholders with customers, employees, suppliers, and local communities. Perkins suggests that we demand that these corporations take actions to honor those commitments.

In Touching the Jaguar, there is a resource section that asks who you are and suggests how you can change the world with examples of daily practices. Much of the book covers Perkins' biographical activities including an attempt on his life. His books have been published by Berrett-Koehler Publishers, which is an independent publisher dedicated to connecting people and ideas to create a world that works for all based on values of quality, partnership, inclusion and sustainability

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

The Global Economy Crumbles

Cont'd from p.1

the collapse of global manufacturing links shows the foolishness of globally distributing just-in-time manufacturing to wherever components can be made cheapest.

The U.S. drug industry is an example, where the hidden goal is to maximize profit at the expense of the sick and elderly. The U.S. outsourced generic drugs to India, which then outsourced some components to China. As manufacturing and supply chains collapsed, medications and now reagents for the COVID tests have become difficult to obtain. Contrast Germany's well-managed universal health care and the capitalist shambles in the U.S. Research scientists in Germany identified the new virus threat in late December, and with the full support of the government, developed a test by mid-January, went into production at the beginning of February, and soon could test more than 500,000 people a week. So, Germany has COVID-19 relatively under control. But in the U.S, the central government has been both incompetent and largely in denial. As a result, a dozen private companies developed competing COVID tests, using different reagents that had been outsourced to China, so availability was limited. Not surprising that in the U.S. the death rate has spiraled.

This global pandemic is one example where reality has intruded on sacred "free-market" theology. Climate change is another on a longer timescale. A third threat is that if a major solar flare strikes the Earth, which has not yet happened during the satellite era, global communications may be lost, leading to a collapse of a different kind.

Several things are needed for long-term resilience and stability for humanity and the Earth. First, a move to the re-localization of our industry, food and medical supplies, so that local control is possible on a regional scale, not by global empires which exploit people for profit without moral guidance. This will also reduce the burning of fossil fuels for global trade.

Second, we must reinvent our economic system to include all the true costs, both present and future, and especially the huge long-term costs of using fossil fuels. Now is a perfect time to add a fossil-fuel carbon tax, when the price of oil is low, to fund the transition to an efficient society powered by renewable energy. The public would not notice, but what is obvious to us is unthinkable to the rich and powerful oil industry, which is demanding instead subsidies to protect profits-as-usual.

Third, we must strip our economic and health-care systems of the many injustices embedded in capitalism, both to people and the Earth itself. It is outrageous that so many people are poor, because they must work for low wages for this unjust and unsustainable system, until they are sacrificed in a crisis. We should expect rebellion and provide guidance.

Fourth, we must step away from the endless pleas for growth, and grasp the simple reality that exponential growth of the consumer economy means sacrificing the Earth just so some can profit. This, too, is stupid when our engineers could easily and cheaply build long-lived products for a sustainable society, instead of the throw-away culture that was started in the 1950s.

We can also delight in the benefits from the large economic downturn. The decline in the pollution from air travel and less driving helps the Earth. The global drop in air pollution from the reduced burning of fossil fuels benefits the planet, and human health.

We the people now have a window of opportunity to help drive this transformation. It will take community organization and immense effort. Expect only opposition from our clueless central government, which is trying to buy its way out of this crisis by borrowing money. Remember to find time as the world slows down to sit outside and rejoin the living natural world.

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

2020 Record Warm Year? Don't Bet on It.

Dr. James Hansen

April, 2020.

This year, 2020, should have record global warmth according to widespread media reports in April. The reports were based largely on a NOAA conclusion that such a record was likely with 75% confidence. April has since come in with record warmth for the month, although practically the same as April 2016. That should seal the deal, right?

Not so fast. Their expectation is based on the fact that the first few months of 2020 are almost as warm as the same months in 2016, and the fact that global temperature fell rapidly in the last eight months of 2016, as the super El Nino of 2015-16 faded and was replaced by a La Nina in the tropical Pacific Ocean.

The graph shows the Nino temperature index, including the NOAA NCEP model projection, which predicts a rapidly developing La Nina this year. So, the 2020 global temperature may fall as fast or faster than in 2016. A strong La Nina, if it occurs, will affect 2021 as well as the rest of this year, in which case we do not expect record annual global warmth until 2022, at the earliest.

The game of predicting near-term global temperature records is of little import. We just want to insure against public misinterpretation, if, as is perhaps probable, 2020 does not achieve the predicted record.

Tropical ENSO (El Nino Southern Oscillation) variability is the largest cause of inter-annual variability of global temperature, but there are other factors. The increase of greenhouse gases, mainly CO2 and CH4, will give 2020 a warming boost, but that will be partly offset by the present deep minimum of solar irradiance. The wild card is caused by a reduction of human-made aerosols, due to reduced emissions during the ongoing global Covid-19 epidemic. Reduced aerosols will cause a boost in warming, but unfortunately global high-quality aerosol measurements are not being obtained.

May 2020 was the warmest May since adequate global data began in 1880, exceeding the next warmest May (2016) by 0.060C. Global surface temperature was 1.020C relative to the 1951-1980 base period and 1.290C relative to 1880-1920.

Siberia continued to be unusually warm, with a large area more than 40C warmer than during the 1951- 1980 base period. However, large portions of the United States, Canada, Europe and Australia were cooler than they were in the 1951-1980 average.

The first five months of 2020 are the 2nd warmest January-May in the record at 1.160C relative to 1951- 1980.

The last seven months of 2016 were relatively cool, aided by a shift from El Niño to La Niña conditions in the tropical Pacific, so 2020 has a chance to be the warmest year. Thus, there were widespread media reports that 2020 likely would be the warmest year, based mainly on a NOAA prediction.

Our update last month suggested caution with that prediction, because of strong evidence that 2020 is also headed into a La Niña. The research group predicting El Niño and La Niña has become notoriously conservative, almost waiting until one is in place before "predicting" it, but the NCEP model for several weeks has been consistently predicting a rather strong La Niña

In a companion communication we discuss what might be learned at the end of the year from comparison of 2016 and 2020 in their race for the title of the warmest year.

Supporting graphs available at https://csas.earth.columbia.edu.

Dr. James Hansen, former director of the NASA Goddard Institute for Space Studies, is director of the Climate Science, Awareness and Solutions program at the Columbia University Earth Institute. ♻

The problem: Atmospheric CO2 concentrations are at an all-time high.

LET'S LOOK AT SOLUTIONS.

N.R.Mallery, publisher of
Green Energy Times

Despite COVID19, atmospheric CO2 concentrations still reached a record peak in May (https://www.co2.earth), perhaps rising higher than scientists expected, It is clear that we still have a huge problem on our hands. At the writing, CO2 stands at 417.16ppm. This is an alarming concentration that should be of concern to all of us!

We have a huge problem, a climate emergency. There are parallels with the pandemic, in that we just don't have ready solutions. The climate crisis looming over us, whether we want to pay attention to it or not, is equally immediate and much longer-lived than any epidemic. What are the solutions to reduce the rising levels of CO2 concentrations in our atmosphere?

What can we do about it?

- **First and foremost, we need to get completely off fossil fuels.** Sounds simple enough until you think about how much we rely on them. But despite our dependency there are actually a lot of opportunities to reduce our use of fossil fuels.

How do we do that?

- Stop supporting all businesses that support fossil fuels. Make it a point to research the banks you use, your insurance companies, your own investments.
- Of utmost importance, seal and insulate your home, so you eliminate heating or cooling losses that keep you reliant on fossil fuels.
- Go solar so your electricity is from a renewable resource. Once you invest in solar, you will immediately see savings on your electric bill. This will also allow you to convert heating and cooking appliances that consume gas, propane or oil, to electric-powered versions, so your solar generated energy becomes even more valuable to you and your dependence on fossil fuels is further reduced. There are many incentives and ways to work with your state and your local solar installers. And then too, there are ways to perform your own installation in consultation with experts. If you rent, do some research and talk to your landlord or join in with a community solar project (again call the solar installers in G.E.T. or near you to find out how).
- Replace your gas appliances with electric ones, especially if you are connected with solar from the grid or your own system. Your utility and Efficiency Vermont can help make this step more affordable.

Cont'd on p.32

NHSaves Home Performance with ENERGY STAR Doubles Rebate to $8,000

New Hampshire's residential weatherization (air-sealing and insulation) program, Home Performance with ENERGY STAR (HpwES) (pronounced "hip-wiss") is doubling incentives for participants as follows:

- Incentives for insulation and health and safety are increasing from 50% of project cost to 90%
- Caps on incentives amounts per home increase from $4,000 to $8,000
- Over $8,000 in incentives are allowed with utility supervisor review
- New cap includes incentives for heating systems
- Customers must install recommended electric savings measures in order to get weatherization incentives
- Increased incentives are initially available for projects that are completed by November 15th, 2020.

Learn more at www.nhsaves.com

Achieving Net-Negative: Buildings as Carbon Sinks

Jessie Haas

Materials link you to the larger world; to factories, smokestacks, mines, and oil-rigs, or to fields, forests, sun and soil. The materials used in a building can bring with them a large carbon debt that will take decades of operational efficiency to pay off, or they can turn a house into a carbon sink that's already carbon-negative on day one.

This was the message delivered at the Better Buildings by Design conference, February 2020, by Chris Magwood of the Endeavour Centre in Peterborough, Ontario, and Jacob Racusik and Ace McArleton of New Frameworks in Burlington, VT, in a talk titled "Carbon Drawdown Now."

The planet exchanges carbon among five spheres; the biosphere, pedosphere (soil layer), lithosphere earth's crust and mantle, atmosphere, and hydrosphere (waters). Carbon sinks absorb more carbon than they release. According to the speakers' analysis, buildings built with biogenic materials can become the world's sixth carbon sink, with a surprisingly large impact. Project Drawdown identifies twelve building-based climate interventions. Using a biogenic supply chain can nearly double that impact.

Biogenic materials are mostly plant-based (sheep-wool insulation is second-generation plant-based, since sheep eat plants). Often, they can be swapped out one-for-one with synthetic materials. Simply choosing blown-in cellulose insulation over synthetic spray foam sequesters plant-based carbon for the lifetime of the building. Biogenic materials include wood, wood fiber board, hempcrete, straw board, straw bales, bamboo, cork, rice straw MDF (medium-density fiberboard) mycelium, cellulose, and ReWall (sheathing board made from recycled, compressed drinking cartons). Many of these choices don't require a radical rethink but make a large impact on a building's carbon debt.

Plant-based building materials sequester carbon in two ways. First, plants use it to build their own structures which are then preserved for the lifetime of the building. Second, plant roots build a certain amount of carbon into the soil, depending on how they are grown. Wood, for instance, should be sustainably harvested from well-managed local forests for maximum carbon-sequestration. Crop-based materials should be regeneratively farmed using minimal tillage.

Paying attention to how materials are grown closes the loop between construction and the farms and forests where the supply chain originates. It creates community and brings profitable activity to rural areas. One example is a new factory next to a California rice farm that converts leftover straw into rice straw board, a form of MDF. Formerly, the rice stalks were rotted by flooding after harvest, releasing copious amounts of methane. Now, the carbon drawn out of the air during the growing season is sequestered in buildings, where it will likely remain for at least 100 years. Sequestration happens now, at the beginning of the building's lifetime, which is when we urgently need to draw down carbon to avoid the worst effects of climate change. Under this model, operational savings over the building's lifetime are an added benefit.

Happiness Hill is a straw-bale addition to an existing cabin which New Frameworks built in 2014. The house is built with natural clay plaster finish on the interior, local wood siding exterior, and an interior local wood timber frame. The square footage of the home was doubled while keeping the energy usage the same. Photo credits: Stina Booth Photography, 2017.

Magwood of the Endeavour Centre offers four models for constructing a house, with escalating degrees of care for the environmental impact of materials. His conventionally built home has a net-emission debt of 207 tons of carbon. Without deviating far from current building norms, the same house can become a net carbon sink (-15 tons). By making the absolute best choices, using materials that currently exist but may be uncommon, a builder can achieve -117 tons of carbon sequestered.

He has found that choosing materials based on their global-warming potential reduces other kinds of negative impact, such as ozone depletion, acidification, and depletion of fossil fuels. These materials contain no noxious chemicals, so are healthier to live with, recyclable, or biodegradable.

Materials choice in retrofits and weatherization can also sequester carbon. Efficiency Vermont is currently conducting a study to ensure that weatherization materials do not cause unintended environmental damage. Affordability is also a consideration Generally, it seems that materials with high embodied carbon do not increase the cost of projects.

For all construction to become carbon-negative by 2030, builders should stop using high-carbon materials now, move to readily available, moderate-carbon materials within two to three years, go to carbon-zero buildings in three to five years, and aim for all buildings being net-negative in five to ten years. Can we? Watch the video and judge for yourself. It can be viewed at https://www.efficiencyvermont.com/trade-partners/bbd/keynote. You may come away feeling quite inspired.

Links: http://endeavourcentre.org/; https://newframeworks.com/

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

Do-It-Yourself Energy Upgrades: Insulation

David Keefe

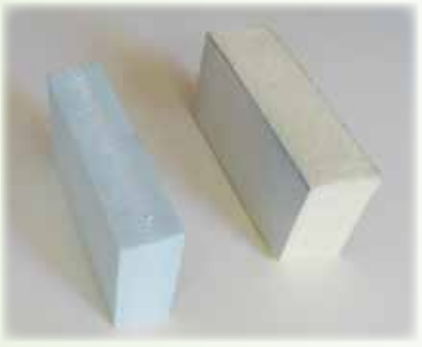
#6 in our new DIY Series, kindly brought to you through Efficiency Vermont.

If you're installing insulation, you want to choose the right material. Here we'll review some common building insulations.

Vermiculite isn't an insulation you would choose to use today, but you might find it in your house. It's a loose gray granular material, often somewhat metallic looking. This material is known to contain asbestos, so it should only be removed by an appropriately-licensed contractor.

Fiberglass is the most common insulation used in buildings nationally. It's one of the least effective and least expensive types of insulation. Fiberglass can be blown-in but most of it is sold in batts, which are handy for DIYers, because you don't need any special equipment to install them. The biggest issue with fiberglass batts is getting them to fit well without any gaps.

From left, rigid rock wool, wood fiber insulating sheathing, cellulose blanket. Images: Dave Keefe.



From left, extruded polystyrene, polyisocyanurate.

Rock wool is like fiberglass but made of rocks instead of sand. It comes in batts or rigid sheets. Rock wool doesn't burn. The rigid sheets are becoming more common as continuous insulation layers on walls and roofs.

Cellulose is recycled newspaper or other wood fiber, blown as loose fill material in attics, or as cavity fill in walls and sloped ceilings. It's very environmentally friendly because of its high-recycled content and carbon sequestration. When blown into cavities as "dense pack," it can make a big difference in air tightness.

Extruded polystyrene (XPS) is a rigid plastic foam sold in sheets, typically 2 feet by 8 feet and in various thicknesses. Color varies with the manufacturer. Dow's is blue and typically called "blueboard." Owens-Corning's polystyrene, like their fiberglass, is pink. The crews call it "pinkboard." This material is commonly used as exterior foundation insulation. XPS is an excellent insulation but has some significant environmental issues in its manufacture.

The tan-colored foam that comes in 4 foot by 8-foot sheets, in various thicknesses with aluminum facings is polyurethane or polyisocyanurate. It has the highest R-value per inch of any common insulation except spray foam, so it's well-suited to places where we want a lot of performance in a thin profile. It can work well as a continuous layer. It's a vapor barrier, so in cold climates it can trap moisture in walls and roofs if used inappropriately.

Spray polyurethane foam is essentially manufactured on the spot by mixing two components which chemically react. It is sprayed onto a surface as a liquid and immediately expands to fill whatever space it's in. When sprayed onto a flat surface it expands to a layer typically two to four inches thick. Multiple layers can be added. This material has a very high R-value, and because of the expansion and adhesion, it tends to fit well and adhere in place. In older housing stock, spray foam is commonly used on stone foundation walls. There are concerns about chemical sensitivity. It appears to only be an issue for a very few people, but when it's a problem it's a big problem. Even people who are not sensitive should not be around it until it is fully cured. Some people don't like it because of environmental impact. And compared to other insulations, it's expensive.

Image: www.roofingsuperstore.co.uk

Spray foam is usually mixed and dispensed using a truck-mounted rig, so it's usually not a do-it-yourself material, but it can be. You can buy small spray foam kits. They are very handy but not environmentally friendly because these are one-time kits that generate a lot of waste. If you use one, make sure you read the manufacturer's instructions for respiratory protection and follow them.

Almost all plastic foams, whether spray or rigid sheet, must have a fire-protective layer installed. The most common materials are drywall and a special intumescent paint.

These are the most common insulations, but if you want to try insulating with cotton, wool, straw, hemp, rice husks, cork, or even mushrooms, there are companies out there doing some of those approaches. Some are using waste materials as raw materials and consciously moving away from carbon-emitting activities to carbon-storing ones. A good thing.

Dave Keefe is a fifth-generation Vermonter who has worked for over 35 years as a contractor, consultant and teacher to improve the performance of existing homes. ♻

Zero Energy Now is Back!

George Harvey

Farmhouse, Underhill, VT. Energy saved: 88%; annual energy cost savings: $3,885. 71% renewable energy – solar PV, cord wood, and pellets. Photo: Building Energy.

The June 2017 edition of Green Energy Times had an article, "Saving 79% in Existing Homes," which provided an initial report on the results of the Zero Energy Now (ZEN) program (https://bit.ly/GET-ZEN-saving). The program was designed by Vermont's trade association of home performance contractors, Building Performance Professionals Association (BPPA), in 2015. Its purpose was to save fossil-fuel use in existing homes in Vermont.

The ZEN program was supported with funding from Green Mountain Power, through its Community Energy & Efficiency Development Program. The funding came through in February 2016, and the work on homes had to start quickly after that, in order to be completed on all of the projects before December 31 of that year.

Each site had to be evaluated. Weather sealing had to be done and insulation installed. Heat pumps were installed for heating and hot water, and those for heating were either air-sourced or ground-sourced, depending on the individual situation. Solar systems were also installed as major parts of the projects.

An overall study to examine the results of the program included 24 of the buildings in the program, about two-thirds of the total. The study showed that the program led to impressive savings. The program and other incentives had reduced homeowners' costs of installation to a net average of $31,090. The average savings on energy came to $3,692 per year, which is a return on the investment of 11.9%,

Together, these homes had reductions of 8,820 gallons of heating oil and 3,103 gallons of propane. The solar systems generated 201,468 kilowatt-hours of electricity. The great majority of the homes had energy savings of over 40%, the average was 79%, and one saved 98%.

There were a number of lessons learned from analysis of the projects in the pilot program. One is that a comprehensive approach to energy savings is very important. The systems put into place should be able to work together toward the goal of reducing energy and fossil fuel use. The overall design for a project must take this into account.

There were two observations about heat pumps. One is that it is important that the unit be properly sized for the house. Another is that wood-fired heat is a good backup.

None of the homes in the program was new, and the designs of the homes varied widely. Because of this, the program was able to demonstrate that the methods used are broadly useful. Even rather old buildings were able to benefit from the upgrades.

One particularly noteworthy finding is that occupants of the homes should be educated about how their new energy systems operate. This is especially true in relation to heat pumps, which are not familiar to most people.

Having done that work and evaluated the results over time, BPPA is bringing ZEN back. This time, the program is no longer a pilot project. Instead, it is starting up with intention of making use of the lessons of the pilot as an ongoing effort. The new full ZEN program will be kicked off in June or July, once the final formulating stage is complete. The program will begin with contractor training and jobs for those who took part in the pilot.

BPPA hopes to complete retrofits on ten homes by the end of this year. The intent is to double that number in 2021, and double that again in 2022.

One thing that is getting a lot of attention by the people involved at BPPA is financing. There are several foundations involved already, including funding from the Energy Foundation, and commitments from Vermont Community Foundation and Efficiency Vermont. BPPA is working with Northeast Energy Efficiency Partnership. And it has a number of grant requests already underway.

Clearly, homeowner participants are needed, though only ten can be chosen this year. Anyone interested should contact Gabrielle Stebbins (BPPA) at 802-825-9515. ♻

Farmhouse, Newfane, VT. Energy saved: 98%; annual energy cost savings: $2,901. 94% renewable – solar PV. Photo: Integrated Solar Applications

Raised ranch, Thetford, VT. Energy saved: 95%; annual energy cost savings: $2,042. 94% renewable – solar PV and cord wood. Photo: Building Energy.

Ranch house, Jericho, VT. Energy saved: 95%; annual energy cost savings: $1,732. 90% renewable – solar PV. Photo: Building Energy.

Green Decking Materials

EarthTalk® From the Editors of E – The Environmental Magazine

Kebony is a sustainably-harvested pine product that is modified at the molecular level to be stronger, so it can last 3-5 times as long as other decking materials. Credit: Kebony.com.

As the weather warms up, we gravitate toward the outdoors, and what better way to enjoy the sunshine than on your very own deck? If you are building a new deck or sprucing up an existing one, you have the opportunity to make "green" choices so you can relax outside guilt-free. There are plenty of attractive and low-maintenance options out there these days that won't break the bank or ruin the planet.

Of course, most of us think wood when we think about our ideal deck. It's non-toxic, natural, renewable and recyclable, and it biodegrades without any polluting by-products. Cedar, which is naturally rot- and insect-resistant, may be the most common decking wood, but it takes regular maintenance if it's going to look its best and last more than a few years. Redwood is another great naturally hearty choice for decks, but it's hard to come by—and expensive—given limited supply. Another common wood for decks is pressure-treated yellow pine, but the chemical impregnation that makes it stand up to the elements doesn't look great, and, even worse, can leach copper into aquatic ecosystems.

Then there are the tropical hardwoods, controversial given the decimation of tropical forests by mechanized logging since World War II. But certification of these woods as "sustainably harvested" by non-profits like the Forest Stewardship Council (FSC) can help consumers on the hunt for deck wood feel better about their use of ipe, garapa, cumaru or tigerwood—each of which evolved in the tropical rainforests of Latin America and is known for durability and natural resistance to rot and insects. Ipe, given how attractive it looks, and that it can last up to 40 years in a decking application, has become especially popular in recent years.

That said, just because

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AeroBarrier™ Case Study:

WHERE'S THE WATER COMING FROM?

Simple Rules, Complex Systems

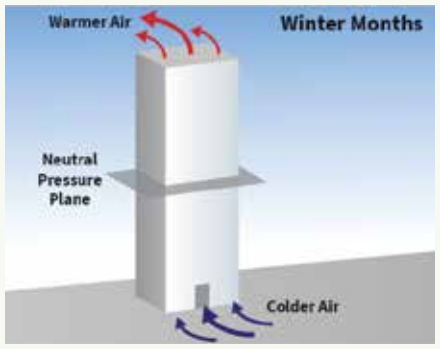
Nate Gusakov

The physics are relatively simple. Here are the two most important rules: 1. Heated air rises. 2. Condensation occurs when warmer moist air meets a cooler condensing surface below its dewpoint. When you're talking about condensation issues in houses, those are really the only two rules that matter. The complexity comes about when those two rules are applied throughout the entirety of a home's building envelope. One of our consulting jobs was a house that was suffering from the effects of these two rules.

A single-fan blower door test set up to depressurize the building and help determine where the air was leaking the most. Images courtesy of Nate Gusakiv.

The house in question was fully renovated just a couple of years ago and had spray foam insulation applied to the underside of the roof deck. What had been the attic is now partly finished space with an open door to a mechanical room where you can see the foam insulation. Since renovation, each winter when temperatures get cold enough, there is a lot of water that comes dripping out from the top of the roof trim outside and stains its way down the trim and clapboards. Is the brand-new roof leaking? Where's the water coming from?

Because of the basic shape of most houses and the fact that we heat them in the winter, there is usually something called stack effect in, well…in effect. When the air we heat rises, it travels up through the floors and stairways of the house and pushes against the attic. If the attic plane isn't air-sealed, the air just keeps on going right through the attic and outside. Cold air is drawn in through the bottom of the house to replace it, is subsequently heated and continues to rise, and voila – a convection loop! Not only does this send valuable heat out of the house quickly, it also pushes a lot of water vapor up towards the roof (vapor from our cooking, showers, plants, breathing, etc.). If enough of this water vapor finds a cold enough surface, it will condense into liquid water on that surface.



After diagnosing with a blower door, thermal imaging camera and theatrical fog machine, we were able to figure out the cause of the water: An incomplete spray-foam installation is allowing warm moist air from the house to rise past the insulation in some places, where it will then condense on the roof plywood and roll down under the roofing itself to make its way out onto the trim. Understanding the cause of the problem enables us to properly devise a solution and understanding the simple physics involved helps us find the cause.

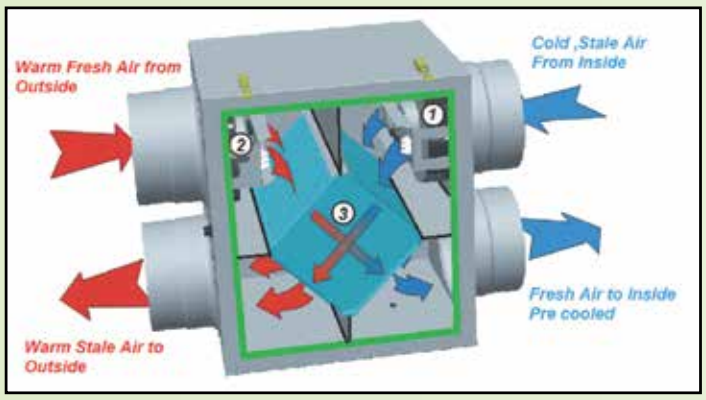
Nate Gusakov is a lead auditor for Zone 6 Energy. Zone 6 Energy is a home-grown Vermont company specializing in air leakage diagnostics and consulting. Zone 6 Energy offers commercial and residential blower-door testing, home energy audits, and AeroBarrier installations throughout New England and upstate New York. ♻

Summer Ventilation and Cooling Options

Michael Canavan

Now that summer is approaching, homeowners need to consider the summertime ventilation and cooling needs for their homes considering energy usage.

Natural ventilation is as simple as opening windows on your house in a way that creates a cooling natural draft throughout the house. If you open the upper level windows in your house on the sunny side and the lower windows on the shaded side of the house, with interior doors open, you will create a natural draft throughout the house. Warm air rises and cool air sinks which creates the draft. The strength of the draft will depend on the house layout. If you open the furthest windows on each level it will help create the largest air movement. This method has been in use for hundreds of years before air conditioning became common in homes in the 1960s. Adding a whole-house fan will give you a higher airflow in the house. This method is good when the air is less humid, say, below a dew point of 60 degrees. Fresh air is one of the ways thought to reduce the Covid-19 transmission by replacing stale air with fresh.



Using air-to-air ERV to pre-cool the fresh air in summertime. Image Wikimedia Commons/MoeSalem

As the humidity rises, you will want to dry the air out. This is where the air conditioner unit comes in handy, as it cools the air by transferring heat energy to the exterior and also lowering the humidity. General recommendations are to use air conditioning when the outside temperature is above 78º Fahrenheit and the relative humidity is above 60% but adjust the settings for what makes you comfortable for most of the time. A central air conditioning system has an exterior (condenser) unit that should be shaded, with open space around it, to allow the heat to dissipate away from the condenser unit. The unit should be monitored for clean coil fins weekly, looking for grass cuttings, large pollen seeds (milkweed) and general dirt. Hose off the unit as needed with the unit turned off. On the interior, the air filter in the furnace will need to be changed or cleaned, and make sure the supply and return duct vents are not blocked. For window type units, clean the filter at least on a monthly basis, adjusting based on the level of material on the filter. Clean filters keep both types of systems running more efficiently with better air heat exchange. If you have an air conditioning unit that is more than 10 years old, you should consider replacing it due to the improvements in technology that make the new units much more energy efficient. Always look for the Energy Star rated units.

"Split" heat pump units are becoming more common these days due to greater efficiencies of the units. Heat pumps are for both heating and cooling; they are similar to conventional air conditioners with a valve that lets the coolant flow in the opposite direction depending on whether the thermostat is calling for heating or cooling.

Air conditioning systems should be sized for the building heat and cooling loads. Window units and central air systems are generally sized for one ton (12,000 BTU's) of cooling load for 600 square feet of living space. Heat pumps are sized similarly but consider some building conditions, for instance, window glazing, which helps to increase the efficiency. Air conditioners should be set so they dehumidify the air and cool it to about 10 degrees below the outside air temperature, which provides most people with relief from the heat. Dry air will feel cooler even if the temperature is higher, not necessarily 68-74 degrees Fahrenheit on the set-it-and-forget-it thermostat.

There are some other things to consider for staying cooler in the summer. Deciduous shade trees provide cooler air underneath them. compared to being out in the sun. Foundation plantings are great to shade the concrete foundation walls, which will also keep your house cooler. The screens on your window will provide some shading to the glass, the least insulated part of a wall. Closing your blinds or curtains will also block heat from circulating into the home. Hard surfaces like asphalt and concrete driveways and walks hold and reflect heat into and around your house. .

Michael Canavan is the owner of Eagle Home Inspection Solutions of Norwich, Vermont. Learn more at www.EagleHomeInspectionSolutions.com, or (802)526-2642. ♻

Cold-climate mini-split heat pumps can replace air-conditioning units efficiently. Courtesy image.

CO2 at All-time High

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- Build with carbon-sequestering materials (see article on page 28 of this issue). We have a lot of CO2 to get out of our atmosphere. This is one more way to help, along with planting trees and sustainable agriculture practices.
- Get heat pumps to keep your home or business comfortable all year round. There are many incentives and rebates for cold climate heat pumps, geothermal systems and other alternatives for temperature regulation that free you from being dependent on fossil fuels.
- If you heat with wood, be sure to update your stove or furnace with a modern unit that keeps emissions and pollution to a minimum. (Support biomass for HEAT and not electricity. There is a huge difference when wood is gathered sustainably and locally with forest management practices!) There are many rebates and savings available for these appliances. Check out the incentive page for your region on pages 14 and 15.
- Drive electric cars, trucks, trains, buses, boats (or muscle-powered), motorcycles and scooters. All are available today with more becoming available all the time. Please don't wait to take this step in hopes of something better. (The future of our planet and children's lives will not wait for you). Electric bicycles are another great option to consider for some of your transportation needs without the use of fossil fuels. Many utilities are offering rebates to make them more appealing and affordable.

Concentration of CO2 in the Atmosphere

417.16
parts per million (ppm)
June 12, 2020
www.co2.earth.

- Use electric lawnmowers! The emissions from gas-powered mowers is more than you realize. Many utilities are also offering rebates for them, as well. See the article on page 39.

Other solutions to consider:

- Work from home
- Limit your trips outside of your home
- Grow more of your food and store it!
- Do not use chemical non-organic fertilizers or weed killers like RoundUp (see article on page 20 of this issue).
- Compost your food and yard waste and use it in your gardens!
- Keep your waste to a minimum and recycle all you can.

Two of the most important things we can all do to help to get our CO2 emissions down and even give humanity a chance to survive what the future holds for our planet are:

- Support the carbon tax by putting a price on the use of fossil fuels.

Cont'd on p.36

FEED Kearsarge Nourishes Our Community

Jennifer White

Many local organizations have worked diligently to alleviate temporary food insecurity and improve the long-term resilience of our food system by offering emergency assistance, fostering beneficial relationships, providing local products and creating educational opportunities. The unprecedented social and economic impacts of the COVID-19 pandemic have intensified many of those existing regional challenges and revealed the fragile nature of our dependence on a global food system and supply chain.

The FEED Kearsarge initiative's key collaborators: Greg Berger (Spring Ledge Farm), Steve Allenby (Kearsarge Neighborhood Partners), Hanna Flanders (Kearsarge Food Hub), and Leon Malan (Colby-Sawyer College). https://www.youtube.com/Feed-Krsg.

Our New Hampshire community needed a rapid, collective response to strengthen the capacity of our existing support networks to ensure the availability of necessary resources for all — specifically, access to healthful food. FEED (Food Expansion, Education, Distribution) Kearsarge is a collaborative network of organizations committed to nourishing our community by feeding and empowering ourselves and our neighbors.

The growing list of partners includes Colby-Sawyer College, Spring Ledge Farm, Kearsarge Food Hub and Sweet Beet Market, Kearsarge Neighborhood Partners, Kearsarge Lake Sunapee Community Food Pantry and New London Hospital. FEED Kearsarge's initiatives are designed to improve the immediate health of residents in crisis, while also promoting the perennial wellbeing of the regional food system and the local economy.

Spring Ledge Farm and Colby-Sawyer's own Main Street Garden will oversee the cultivation of crops most in demand by food pantries, schools and New London Hospital's Food Rx program. These additional garden rows, totaling more than an acre of land, will provide at least 1,000 pounds of produce and will feature primarily root crops, which would be available to recipients long after the growing season is over. Kearsarge Neighborhood Partners (KNP) will help raise funds for materials and identify volunteers and paid assistants who will help tend the designated land and then process and deliver the produce. Kearsarge Food Hub will help coordinate the aggregation and distribution of food to local pantries and the hospital program.

Through a program called "Tray it Forward," participants of Spring Ledge Farm's annual seed sowing workshop have donated 250 trays of easy-to-plant seedlings to essential medical workers and families with stretched finances. Spring Ledge split the cost of the trays with donors, and Vermont Compost Company and Pleasant View Gardens contributed planting materials.

Kearsarge Food Hub workers and Colby-Sawyer College students will offer educational materials and technical training to promote more at-home food production and preservation. Inspired by historic victory garden programs, they will also provide sample garden-planting designs to help families be more successful and self-sufficient. The Food Hub and the college will also run a pilot program in which they will establish three model victory gardens at the Kearsarge Regional Elementary School at Bradford, the Bradford Community Food Pantry, and the Brown Memorial Library. Interested donors and volunteers for FEED Kearsarge should contact Kearsarge Neighborhood Partners at knpnh.org.

Jennifer White is the director of sustainability and innovation at Colby-Sawyer College where she collaborates with stakeholders to implement policies, initiatives, and curricula that promote sustainability and resilience on campus and within the greater community. ♻

Job Creation for Millions Under the Green New Deal

Cont'd from p. 1

defined, and as a result its possible cost has been estimated at anywhere from $2 trillion to $6 trillion -- and higher. We could estimate that the GND would cost about $2.5 trillion in expenditures and would generate more than 18.3 million jobs. This would be a relatively modest version of the GND that is concerned primarily with energy and environmental programs. Of course, the economic and job impacts of the GND would vary depending on the size, structure, and duration of the GND specified.

The 18.3 million jobs are a very large number. However, it is sobering to note that in the eight-week period from early March to early April 2020, about 36.5 million Americans filed for unemployment compensation due to the current pandemic. Thus, the 18.3 million jobs are only half as many jobs as were lost in an eight-week period.

Of the 18.3 million jobs, about 2.25 million would be "green" manufacturing jobs, and the impact would be distributed across the economy. The industries involved are not surprising given the parts they play in the evolving transformation to a new green energy economy and subsequent economic growth.

GND jobs would be concentrated within certain sectors, including manufacturing and professional, information, scientific, and technical services. Numerous states seek to expand their high-tech industrial and manufacturing bases. Thus, not only is the relationship between the GND and jobs positive, but the types of jobs created are disproportionately scientific, professional, technical, high-skilled, manufacturing, and high-wage jobs -- the very types that states wish to attract. These jobs are a requisite for a prosperous, middle class society able to support state and local governments with tax revenues. Of particular note, the GND will provide a greater-than-proportionate assist to the manufacturing sector.

Above: A worker scales a giant blade of a wind turbine. Image: Department of Energy/photo by Dennis Schroeder/NREL. Inset is Jessica Kilroy, a musician whose other job is repairing wind turbintes. Screenshot.

The vast majority of the GND jobs would be standard jobs for accountants, engineers, computer analysts, clerks, factory workers, truck drivers, etc., while classic green jobs (photovoltaic engineer, ecologist, fuel cell technician, etc.) constitute only a small portion of the jobs created. In fact, most of the persons employed in newly created jobs may not even realize that they owe their livelihood to the GND. This is important, for a common impression is likely that the GND jobs are for green energy specialists, solar installers, environmental regulators, etc. In reality, jobs for all occupations and skills would be generated, and this should be of interest to policymakers, organized labor, and trade and professional associations.

GND jobs are feasible targets for job creation in many states and regions. With a wide diversity of required skills and continuing research into relevant technologies, communities can focus development of different industry sectors. However, states and cities must recognize that they will be in intense competition for these emerging technologies and industries.

GND jobs will be created across a wide continuum of employment, skills, responsibilities, and earnings. Many of these jobs do not currently exist and do not have defined occupational titles. Further, many of the new jobs require different skills and education than current jobs and training needs must be assessed to enable this rapidly growing sector of the economy to have a sufficient supply of trained employees. Community colleges, technical schools, colleges, and universities must determine how well they are preparing the workforce for the emerging green economy.

Thus, the GND would lead to vast new employment opportunities. Although many high-tech industries almost exclusively require highly educated workers with advanced degrees, the green industries possess requirements for numerous types of occupations, experience, and skills. Many of these jobs require associate degrees, on-the-job training, or trade certifications, all of which pay higher than average wages. The wide variety of entrance points to the green industries makes this market easier to penetrate if regions market their strengths in high-tech, research, education, manufacturing, IT, green technologies, and energy. The potential payoff is game-changing.

To learn more, read the comprehensive analysis of the potential jobs impact of the GND on G.E.T.'s website at https://bit.ly/GET-GND-jobs

Dr. Roger Bezdek is an internationally recognized economist and president of MISI in Washington, D.C. He has over 30 years' experience in the energy, environmental, and jobs areas, serving in private industry, academia, and government. He has served as senior adviser in the U.S. Treasury Department, as U.S. energy and environment delegate to the EU and NATO, and as a consultant to the UNEP, the White House, governmental agencies, and numerous corporations and organizations. He has a Ph.D. in Economics from the University of Illinois at Urbana. rbezdek@misi-net.com. ♻

Elmore Roots' Permaculture Know-How

A Visit from a Great Friend

David Fried

Original painting by Gabriel Tempesta.

One of the great things about winter is the quiet and the time to do things you never get to do during seasons of growing. I go into hibernation. A book by my side and a cup of tea and some dried apple slices from our orchard are all I need for company.

All of a sudden it seems, there are more birds singing and some excited ones announce: the chipmunks are here! I go outside and find them: jumping over fences and darting into stone walls, the earth seems to slurp them inside to their hidden places.

Then I look around the hill. Everything is coming alive. There are leaves opening like parasols, so slowly. An orange newt moves slowly across the forest floor. A new bird arrives in the plum trees and shows me its little red hat, by tilting its head towards me as it flies close to me, as if to say, "Spring!" Another bird sits high up in a buartnut tree and sings five songs at once, so it sounds like it is five different birds, but surprise, only one who can sing its own opera!

Standing in the slope orchard I see a dark lumbering shape walk diagonally across the under grass, and I see this big old porcupine being. I don't think he sees me as he walks right towards me, chewing the new grass and occasionally pausing to sniff the air. When he is about two feet away, I get nervous he will walk into me, and I move my feet a step back. He stops, startled for a moment, then walks in a different diagonal line towards the brook, all quills intact but ruffled up a bit, just in case.

Above our heads is a hawk who takes off after almost scoring a meadow vole. It is so close and so right above us that I tell my friend standing next to me that I think she is telling us something. She is saying, "Look around you brother. everything is coming alive, and you, too, are part of it." We can see the bright stripe across her tail as she circles, again and again, higher and higher so her message will sink in.

There are so many dandelions today that it looks like someone planted just a little green grass amongst them for contrast. The apple blossoms and pear blossoms are everywhere, and you cannot help but smile and breathe it all in deeply. We are part of a very interesting world. Some of it is a little rough sometimes. And some of it is quite wonderful. When a friend comes to visit, whether on four legs or two wings or one stalk, sometimes I can be here to welcome her. Or is she welcoming me?

When we plant a fruit or nut tree and some berry bushes, we are affirming life. All of nature comes to see what we are doing. We are planting something to look forward to. For us, for the bees, for the little beings we cannot even see. These perennial food-giving plants will keep on giving to us and the world, sometimes for hundreds of years. Each spring and summer our new friends we have planted nod to us in the breeze. A few flowers fly off in our direction. A plum drops onto the soft grass below or plunks on our head to wake us up to the wonders around us.

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

Larry Plesent

Ingredient of the Month

Relief Provided by Epsom Salts

Do you have trouble sleeping? Do you get muscle cramps, spasms, or twitches? Are you generally tired and run-down and find it hard to get your energy levels up no matter how much coffee you drink? Do you have inflammation issues like arthritis and chronic diarrhea or high blood pressure? Are you concerned about Type 2 diabetes?

All these issues and diseases have a dozen possible causes. This article is not intended to diagnose or treat any of them. However, if you would like to do something healthy and nutritious for yourself that is without side effects or harm and is believed by many to provide a measure of relief to ALL of these issues…wait for it…GO SOAK YOUR FEET IN EPSOM SALTS.

Epsom Salt is quite beneficial for you. Image: Wikipedia

You heard me right. Epsom salts or magnesium sulfate is a crystal made from two common and nutritionally important minerals that your body uses to conduct in a wide range of metabolic functions, including the absorption of several other nutrients, improving arterial elasticity, improving insulin sensitivity and reducing inflammation throughout the body.

We can imagine that our paleo ancestors with their wild foods diet had little need for magnesium and sulfur supplementation. They got all they needed right from the land. Fast forward two hundred thousand years and a good 50% of modern well-fed humans turn out to be magnesium-deficient.

Epsom salts provide magnesium that is easily absorbed through the skin and quickly travels throughout the body to places where it is needed. Taking supplements is a much less effective way to get the stuff to your magnesium and sulfur-thirsty cells.

Image: healthyhints.com.au

If anything is not quite right in your belly, absorption rates plummet to as low as 10%.

What a fun and easy way to feel better! You will need something to put both your feet into that will hold your feet and a gallon of warm water. Stir in one cup of Epsom salts and read a book or watch a show. Stay in there at least fifteen minutes to a half hour.

You can also add two cups to a warm bath and soak yourself to bliss.

For an added skin treat, put two cups of quick oats into a cloth bag and add that to your full body soak.

Wash yourself off with (handmade soap if you can) after using Epsom salts as they can dry your skin. Rarely, but occasionally, people can have an itchy, allergic reaction to magnesium sulfate. If you do feel itchy or rashy, discontinue, wash with gentle soap and sooth with shea butter, Green Gold or in a pinch, vegetable cooking oil. Happy soaking!

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

Working Together

– Cont'd from p. 11

It is designed to provide at least two to three days of electric power, even if the sun does not shine during that time. With that much storage, it can supply power indefinitely, if reasonable conservation efforts are applied. As it happens, the owner of the home chose to keep the installed generator as a secondary backup.

The Middlesex system includes 27 LG Neon R 365 W panels with Enphase IQ 7+ microinverters. It has a SolArk 12k hybrid inverter, a newer design than the one that was installed in Hinesburg. It is built with a Fortress Power 10-kWh $LiFePO_4$ battery.

Dunn provided a few observations about these two systems. "The biggest thing we learned was the SolArk 8k is a great inverter, and the 12k builds on that to be one of the most flexible, self-reliant pieces of renewable technology we've gotten our hands on. For the right person who wants a system that can be altered at the factory to withstand an electromagnetic pulse (EMP) burst*, [this can be done] with lithium iron phosphate batteries, such as the Fortress Power battery, and it is suitable for full off-grid use."

Fortress Power's website is www.fortresspower.com.

Green Mountain Solar's website is www.greenmtnsolar.com.

** For those who wonder why an EMP burst is important for a home or factory in Vermont, we might suggest looking up the Carrington Event, a coronal solar discharge that caused havoc for the budding telegraph system in this country in 1859 (https://bit.ly/Carrington-event).* ♻

Green Burials: Giving Back to the Planet

Lee Webster

"Nature has a way of opening us up to the moment, to our own grief and to the joy of life—a joy we can feel even in the depth of sadness," said Michelle Menter, burial coordinator at Greensprings Natural Cemetery in Newfield, NY. "It can be the sound of a bird calling, finding a feather on the ground, feeling the wind pick up, or feeling the sun's heat as the clouds part."

This apt description of what it feels like to attend a burial on a nature burial ground or preserve may surprise you, especially if your experience has been more in the "hydraulic equipment, Astroturf, mosquito invasions, and awkward receptions" arena. Many of us who have lived a life of environmental intention are awakening to the realization that we can find ways to benefit the planet in death as well as in life. What started in South Carolina in 1998 with Ramsey Creek Preserve has blossomed into more than 300 cemeteries and burial grounds in the U.S. and Canada that encourage burial without impediment.

We are at last waking up to the environmental damage of conventional burials and cremation, including the denuding of forests for exotic hardwoods used to make elaborate caskets, the carbon-heavy production of concrete for vaults that encase those caskets to flatten the lawn for mowing, and the amount of toxic chemicals being spread or injected.

Those chemicals take the form of known carcinogens in embalming fluid that contribute to an eight times higher risk of myeloid leukemia and a three-times higher risk of ALS, (Lou Gehrig's disease) in embalmers, for starters. Add to that the cardiopulmonary and neurological damage experienced by both funeral workers and groundskeepers who are spraying pesticides and herbicides to keep the cemetery grounds pristine, and we get a better understanding about the dangers of continuing these unnecessary practices. Cremation has its own host of environmentally damaging issues.

Greensprings Natural Cemetery, Newfield, NY. Photos courtesy of Michelle Menter.

Why natural burial? Natural burial grounds promote sustainable management models that are in sync with conservation best practices. They seek to connect people to the land in a profound and lasting way that encourages further land acquisition by providing a pipeline for future support. Many burial preserves double as a place where families and friends can experience life-affirming community activities: hiking, bird watching, picnicking, even hosting dog parties, yoga classes, weddings and baby blessings. These grounds become a habitat for birds, insects, animals, and humans alike.

Simple pine boxes, shrouds made of biodegradable materials, and native plantings are all part of the burial picture that fosters direct environmental benefits to the land. It has long been proved—in fact, since the beginning of time—that bodies buried at the right level and under the right conditions will become one with the soil naturally, without any interference or assistance, and do not pollute soil or water. Soil in fact, is nature's greatest champion, filtering and absorbing anything that our bodies have taken on during a lifetime.

One of the most compelling reasons to consider a natural burial is the enhanced opportunity for ceremony. With the increase of cremation over the past couple of years, the acknowledgement of loss has been swept aside, with families choosing no service or delaying until it is convenient, causing further distancing from the reality and acceptance of death in our day-to-day lives. Natural burial encourages family-led care of the body in preparation of the interment if they choose, and old-school processions, authentic ceremonies, whether assisted, or family-inspired and conducted. And you'll know it's a natural burial when you see the line of shovel handles, even ones for kids, ready for the "cryin' and diggin'" physical expression of grief.

This all adds up to a picture of empowerment around death that has been eroding over past decades. The advantages are myriad: a closer relationship to the new reality with our familial and social orbit; a more affordable and responsible way of caring for the dead; and a give-back to the planet and those who remain long after we have exited.

Menter said, "Folks get a deeper appreciation for the brevity and blessing of life when they experience a natural burial in a nature preserve."

Lee Webster is the President of Green Burial Council International, Director of New Hampshire Funeral Resources, Education & Advocacy, former President of the National Home Funeral Alliance, and a founding member of the Board of the National End-of-Life Doula Alliance, the NHPCO End-of-Life Doula Council, and the Conservation Burial Alliance. As a writer, researcher, hospice volunteer, home funeral guide, conservationist, and frequent speaker on the benefits of home funerals and green burial, her career and volunteer service span years in public relations and development for nonprofits, conservation groups, health agencies, private secondary schools, colleges and universities. She is the author of several books on home funerals and green burial and has published articles and interviews that can be found in various magazines and blogs such as Natural Transitions, American Funeral Director, FuneralOne, Funeral Business Advisor, Newsweek, PhillyVoice, The New Yorker, and many others. ♻

RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions.
To join this group go to: **http://350vermont.org**
American Council for an Energy-Efficient Economy: 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.efficiencyVT.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
Federal Energy Regulatory Commission(FERC): www.ferc.gov
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**
Weatherization, Energy Star & Refrigerator Guide: www.waptac.org
www.susdesign.com Online info for solar benefit with house design: overhangs, sun angle & path…

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CO2 at All-time High

Cont'd from p. 32

Be willing to pay the price of using fossil fuels by supporting the carbon tax. If the higher cost causes you to reduce your use of fossil fuels, it will be to your benefit in the end!

- Support and vote for state and federal leaders who understand the climate emergency and consider it the number one issue they need to address, on top of the pandemic that is also at hand.

Some of these suggested solutions require time to research, but solutions are out there, and you can make these things a part of your life. There are state and federal incentives to help you offset the cost of electric vehicles, solar installations, heat pumps, geothermal conversion, electric lawnmowers, e-bikes, and modern wood stoves. Do some homework on the internet and ask authorities - talk about it to neighbors and friends and encourage them to do likewise. And rest assured, you will sleep better knowing that you have truly done all you can to help to reduce the atmospheric CO2 concentration, now the highest it has ever been. *Thank you for all you do!* ♻

Concentration of CO2 in the Atmosphere

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parts per million (ppm)
June 12, 2020

www.co2.earth.

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GUIDE TO ADVERTISERS

Spark Joy, Not Fires: Safe Battery Use and Storage

Cassandra Hemenway

14,000 tons of rechargeable batteries are thrown away each year - enough to fill 1,273 garbage trucks

Many common items in our lives have serious safety or toxicity problems. For example, we get lulled into a fantasy of its safety simply because a cell phone sits in every pocket and seems harmless. However, cell phones are powered by lithium-ion batteries, which, when improperly handled, spark fires --sometimes massive, hot, fires that decimate buildings and can burn for days (or even years in a landfill).

Lithium-ion batteries aren't the only type of material that requires safe handling, but they are particularly volatile. To complicate matters, it's not unusual for someone to "wish cycle" a cell phone by tossing it into their recycling bin. In January, a fire in a recycling center in Tioga County, NY was apparently caused by a crushed lithium-ion battery. Nobody got hurt, but the fire burned for days through bales of recyclable materials.

In February, a house burned to the ground in Greensboro, Vermont, after the homeowner used "knock-off batteries" without an Underwriters Laboratory (UL) listing in a rapid charger, according to Dan Gauthier, Co-op Insurance investigator. "These batteries sell on eBay for $30-$35, and the name-brand batteries are $100," Gauthier stated in his report.

Greensboro Fire Department Chief, Dave Brochu, explained that the combination of the off-brand batteries for charging a power tool and the "rapid charger" started the fire. A rapid charger, (also known as a "quick charge" or "fast charger") can charge up a battery that normally might take a few hours, in a fraction of that time. It uses significantly more electricity and requires a battery and device designed to be used in the fast charging unit.

Neither of the above examples turned deadly, but such events have that potential, and both were avoidable with safe battery use, storage, and recycling. Recycling batteries properly (not in your blue bin) avoids fires; it also keeps batteries' heavy metals and toxins out of the landfill, which ultimately means out of landfill leachate, and therefore out of our water systems.

The Agency for Toxic Substances & Disease Registry, a federal public health agency, has found that cadmium and nickel, two common ingredients in batteries, are known human carcinogens. Other toxins found in batteries include lead and mercury. So, we have a real incentive to keep batteries from leaching those toxins in a landfill.

Start by finding the closest battery recycling outlet near you.

Call2Recycle manages state battery extended producer responsibility programs and has an information-rich website that includes a zip code-zoned map with drop-off locations. Often batteries can be recycled at the point of purchase, such as at a hardware store or a Home Depot. Go to https://www.call2recycle.org/locator/ to find the nearest battery recycling outlet to you.

Before drop off, you'll need to save batteries at your home. Consider an entire cell phone a 'battery" for this purpose. Call2Recycle drop-off sites accept both batteries and cell phones.

Safe battery storage:

- Place batteries back in their original packaging OR tape the terminal ends of each battery with duct tape or electric tape but don't cover the battery label. This is key to getting it recycled properly. You can also put each battery into a plastic bag if taping is not an option.
- Place cell phones into a plastic bag for safe storage.
- Aim to get your batteries and cell phones to recycling within six months of storage.
- Make sure your batteries are stored in a dedicated location (not loose in a drawer or mixed in with small metal objects) in a cool, dry location.

These few safety steps will minimize the risk of fire and environmental damage and help to get your batteries recycled appropriately.

Scrapped mobile phones for recycling. Image: Wikipedia

Takeaway tips:

- Make sure you are using the correct battery. Avoid off brands.
- Make sure your battery is UL listed. Lack of a UL listing means the item doesn't meet the safety standards of the Underwriters Laboratory. Look for the UL symbol.
- Make sure rechargeable batteries are designed for the charger you're using.
- When ready to recycle, either tape or bag your batteries and cell phones.
- Go to https://www.call2recycle.org/locator/ to find a nearby drop-off site.

Cassandra Hemenway is the Outreach Manager at the Central Vermont Solid Waste Management District. She writes and educates about composting, recycling, and how to avoid use of common household toxins. ♻

Green Bee Lawn & Garden – A Business On a Mission

George Harvey

Tim Roper, owner and operator of Green Bee Lawn Care in Chester, Vermont, has been passionate about the outdoors since he was young. One of his life goals, as a teenager, was to run his own landscaping or garden business. Like most of us with youthful inclinations, his life took a different turn. But eventually, he returned to what he loved. He may be one of the lucky ones. But in his case, the good luck might also be good for the rest of us.

Tim Roper with Green Bee Lawn & Garden equipment. Courtesy photo.

Starting 2007, Roper made a place for himself doing sales in the photovoltaic (PV) business. His early work was for groSolar, in White River Junction, Vermont. The industry was growing fast, businesses were changing constantly, and soon groSolar was sold to SolarCity. Roper continued to prosper there, however. He had skills not only at selling, but at keeping a sales force organized and motivated. In the end, he was Director of Sales at SunCommon, where he worked for over five years.

Like many in his industry, he was passionate about PVs, not only for the world, but for himself. When he put PVs on his own roof, however, he did something a little different from what designers usually recommend. People usually size their arrays to fit their current needs. Roper, however, overbuilt his array, covering his south-facing roof with solar panels. He put in a 9.72-kilowatt system with two Tesla Powerwall batteries, because he saw a coming need for more electricity.

Tim Roper was a success, it seemed, but somehow the lost love of the outdoors kept calling him. Eventually, he decided to go into the lawn and garden business. But it was not to be precisely the business he might have had as a young man. It was to be free of fossil fuels, and it would be kind to the environment.

He founded Green Bee Lawn & Garden last year. Green Bee is built around battery-powered equipment, notably a Mean Green SK-48 mower. He also has what he calls "a bevy of other electric commercial quality equipment." This includes another, much smaller electric mower, an electric chain saw, and an electric blower, all by Greenworks, among other equipment. The only non-electric equipment his business has is the truck. He hopes to have an electric truck in a year or two.

Roper took care to point out that the power tools used for outdoor work that have internal combustion engines (ICE) are highly polluting. A mower can produce as much pollution in an hour as a car does driving a hundred miles. The two-stroke engines used for such applications as chain saws and blowers, where light engines are needed, are particularly heavy polluters.

We may do well to replace our dependence on grid electricity with household PVs, but we can do much more to reduce emissions elsewhere. We need to eliminate the oil and gas we use for heat and transportation. But an even lower-hanging fruit can be had by replacing the small ICE machines with new ones that are electric powered.

Electric units are nearly pollution free, which is good for the health of the operator and for the environment. They are also relatively free of noise, which tends to make happier homes and neighbors.

Roper knew these things and could see change coming. He overbuilt his solar array because he could see that with the reduction in emissions, we would need to depend more on electricity. Now, with the decision to operate electric equipment for his business, the surplus is being put to work.

Green Bee Lawn & Garden is not just about mowing lawns and whacking weeds. Roper said he will do just about anything within his limits. Examples include building raised beds for vegetable gardens, and even planting the garden. He could plant trees for an orchard, if that is what is needed. One limitation is that he does not want to travel very far in his ICE-powered truck, so his customers will have to be relatively near Chester, Vermont.

Roper has a consideration for the environment that is worth mention. "I treat a yard as a habitat," he said. That is really important. "You can feed the birds," he said, "or you can create a habitat that is attractive for birds to live in."

He also said, "Passion doesn't always pay well." But he plans to price his work so it is not more expensive than noisy and polluting lawn and garden work, so there is reasonable hope that is work will be rewarding.

Green Bee Lawn & Garden provides free consultations and estimates for properties within their service area. Contact Tim by email at greenbeelawns@gmail.com, or call or text 802-289-1968. ♻

Electric Push mower. Image: Pixabay

Robotic mower made by Robomow®. usa.robomow.com

Cub Cadet electric riding mower. Image: Cub Cadet.

NEW INCENTIVES FOR ELECTRIC LAWNMOWERS

Reducing Climate Pollution and Saving Money for Vermonters

It's that time of year again! The grass is growing and the lawn needs to be mowed. The great news is that this gas-guzzling, climate-polluting chore can now be completed with much lower emissions and at much lower cost for Vermonters.

With expanded incentives from Green Mountain Power, Washington Electric Coop, and Burlington Electric Department, and low-cost financing from VSECU, there has never been a better time switch to electric lawn equipment.

Through June 30, 2020, Green Mountain Power is offering an increased $75 incentive for residential electric mowers purchased from Vermont retailers (https://bit.ly/GreenUpYourMowing). GMP also increased its incentive for commercial electric lawn mowers from $700 to $2,500 (https://bit.ly/Electric-MowerRebate).

Through December 31, 2020, Washington Electric Coop is offering its customers up to $100 off the qualifying purchase of a new residential electric push mower and up to $1000 on the purchase of qualifying commercial mowers (https://bit.ly/WEC-ElectricIncentives).

With its Mow Electric program, Burlington Electric Department offers its customers up to $100 off the purchase of a new residential electric mower purchased in Vermont before December 31, 2020. Qualifying commercial-grade electric mowers purchased before December 31, 2020 are eligible for an incentive of $3,500. (https://bit.ly/BED-ElectricMowerIncentive).

BED, WEC, and GMP customers who qualify for a commercial-electric-lawnmower incentive are also eligible for an additional $300 manufacturer's rebate from Mean Green Mowers at the time of purchase.

"With summer approaching and Burlington continuing our work to become a Net Zero Energy city, we are glad to continue our Mow Electric incentive program to help our community reduce fossil fuel use by switching to e-lawn mowers," said Darren Springer, Burlington Electric Department General Manager. "Mowing electric saves money on fuel and maintenance, and contributes to cleaner air for all Burlingtonians."

VSECU, a credit union in Vermont, offers low-cost financing for a variety of energy saving projects, including residential electric mowers, through their VGreen Loan program. VSECU is also able to offer business loans for electric mowers at 3.75% fixed rate for a five-year term. This rate is good at least until December 31, 2020. For more information about these commercial loans, contact VSECU's VBiz Team at 802-371-3109 or visit vsecu.com/vbiz.

Fossil-fuel mowers are a source of climate pollution that most of us don't think about very often. We're all familiar with automobile emissions but tend to give less thought to the fossil fuels we use taking care of our lawns. Using a diesel or gasoline-powered mower for an hour emits as much climate pollution as driving 300 miles (source). With over 40 million acres of turf grass in the U.S., the EPA estimates that our gasoline and diesel-powered lawn equipment emits 54 billion pounds of C02 per year!

Steven Wisbaum, a leading Vermont electric mower advocate and founder of Eco-Equipment Supply applauded these efforts noting, "It's really gratifying to see the progress that's been made over the past few years in respect to the transition to electric lawn-care equipment in Vermont. As the performance of battery-electric lawn care equipment has achieved parity with conventional equipment, Vermonters are increasingly discovering the significant environmental and economic benefits of making the switch."

Electric mowers not only reduce climate pollution, they reduce noise pollution as well, generating about one third as much noise as fossil-fuel powered engines. As electric mowers come down in price, they are growing in popularity. Available styles for electric mowers include push, riding, and zero-turn mowers. Like electric cars, electric mowers cost significantly less to operate than the combustion-engine alternative, saving money for consumers on both maintenance and fuel.

Green-e-Mowers, an authorized Robomow® dealer in Bradford, VT, offers many options of all-electric robotic lawnmowers that do not need you to do the mowing. They have applied to be included in this incentive opportunity and expect to be approved. Visit usa.robomow.com or call 802.439.6675.

There has never been a better time to mow electric! ♻

Green Decking – *Cont'd from p. 30*

your tropical hardwood is FSC-certified doesn't mean it's as green as something that grows closer to your home. Factoring in the length of the journey from the source forest to your home—knowing that fossil fuels will be spewed along the way—is key to determining how green your decking choice is overall.

Besides straight-ahead wood, another option is modified wood. Kebony, for instance. This is an FSC-certified pine product that's modified to last three to five times as long as other deck woods. The modification process changes the cellular structure of the wood on a molecular level, increasing its density by permanently swelling and thickening the cells. Thermory is another modified wood product that's excellent for decking, guaranteed to last 25 years without rot.

Beyond wood, composite decking (TimberTech, Trex, Dura-Life, etc.) is gaining traction, even among some environmentalists given that it doesn't contribute to deforestation and the resins used in itsproduction are typically recycled. Unlike wood, these come in a variety of colors, don't need staining or painting and are splinter-free. If you want to split the difference between plastic and wood, Cali-Bamboo's composite decking made from recycled bamboo is a solid choice.

Contacts: FSC, fsc.org; Kebony, kebony.com; Thermory, thermoryusa.com; TimberTech, timbertech.com; Trex, trex.com; Dura-Life, duralifedecking.com; Cali-Bamboo, calibamboo.com.

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