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President Biden signing executive orders. White House photo, public domain.

George Harvey

This should have been TOP headline news for the USA and for the world. On January 27, President Joe Biden may have changed the course of history when he signed a pair of executive orders and a memorandum at a White House briefing. We have posted a full transcript of his remarks at the *Green Energy Times* website, which can be found at [www.bit.ly/GET-Biden-remarks](http://www.bit.ly/GET-Biden-remarks).

This briefing focused on an important issue that many major news outlets seem to notice only peripherally, with no mention on their main pages. The responses from the field were enthusiastically positive. For example, Michael Mann said on Twitter, "This is the boldest climate plan that has ever been put forward by an American president."

Right from the start of the briefing, President

Cont'd on p.20

## CROSS COUNTRY SKIING: IT'S AFFORDABLE, IT'S HEALTHY AND IT'S 'HOT' RIGHT NOW

Roger Lohr

As a result of the pandemic, cross country (XC) skiing is booming across the USA as people want to get outdoors and recreate. Recently, U.S. Ski Team member Jessie Diggins won the Tour de Ski in Europe and is the current point leader on the World Cup season race series. She trains at Stratton Mountain School (SMS). Thirty-five SMS Nordic athletes have made the U.S. World Junior Team and 25 have made the U.S. National Team. Other New Englanders who are on the U.S. Nordic Ski Team and train at SMS include Simi and Sophie Hamilton, Julia Kern, Sophie Laukli, and Katherine Ogden.

These highly-conditioned Olympic athletes can reach and enjoy skiing at speeds above 35 miles per hour (with some help from gravity). The grace and power that's possible to achieve using both technique and fitness is amazing to see and fun to experience! But, there's another side to XC skiing. It can be done at any speed, and many who do it love it for its relaxing, rhythmic movements that



Family at Great Glen Trails in NH with Mt. Washington in the background. Photo courtesy of Great Glen Trails Outdoor Center.

carry one into winter wonderlands. Skiers can pick their own pace, gliding along through fields and forests, stopping when they choose, soaking in the beauty of the natural snow-covered world. It can be as peaceful and quiet as the skier wants, or as energetic, fast and exciting. Every bend in the trail can bring new sights and sounds.

For those that enjoy learning, the possibilities of XC skiing are virtually endless. While an hour's instruction can provide the skills to a new skier to

Cont'd on p.38

## 2020 Was The Warmest Year on Record 2010-2020 WAS THE WARMEST DECADE ON RECORD

George Harvey

In mid-January, a report by James Hansen et al. was posted at the Columbia University web site. "Global Temperature in 2020" makes clear that each of the last six years is one of the hottest six years ever recorded. The hottest year had been 2016, when an El Niño exacerbated the heating. Now, 2020 has at least tied that record, even though a La Niña cooled things somewhat (<http://bit.ly/Global-temp-2020>).

The Hansen report also show that the heating trend has persisted for decades, as the graph shows. Since the 1970s every decade set a new record as the hottest on record. Please consider this:

- The decade of 1971 to 1980 was considerably warmer than the decade before it.
- The decade of 1981 to 1990 was hotter yet and set a record as the warmest ever.
- The decade of 1991 to 2000 broke that record and became the warmest ever.
- The decade of 2001 to 2010 broke that record and became the warmest ever.

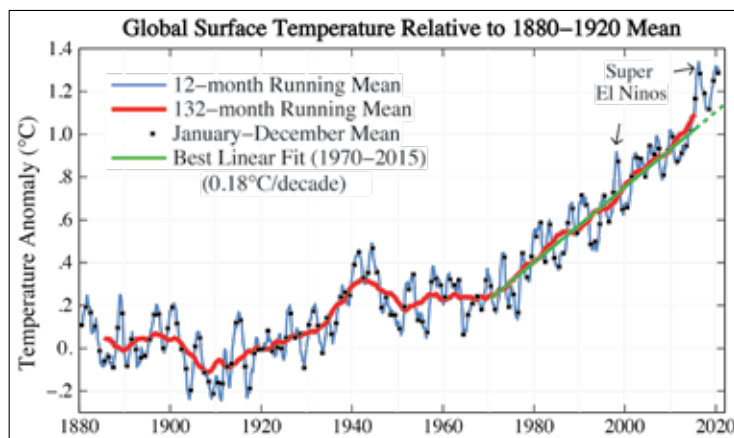


Image courtesy of Dr. James Hansen.

- The decade of 2011 to 2020 broke that record and became the warmest ever.

The pattern is unmistakable. It also presents a problem. As the Earth has warmed, the effects of warming have become increasingly alarming. The damage from climate change is already dangerous.

There may still be hope, but to realize that hope, we will have to act.

The previous edition of *Green Energy Times* had the article, "Climate Change Is Pushing Record-Setting Disasters" (<http://bit.ly/GET-record-disasters>). It speaks to a year in which record after record was broken. The year had the greatest number of named storms in the Atlantic hurricane season. Twelve named storms made landfall on the contiguous U.S. The previous record was nine.

NOAA published a brief report, "U.S. 2020 Billion-Dollar Climate Disasters," providing a list of weather events that did over \$1 billion in damages (adjusted for inflation) in the U.S. There were 22 of them in 2020, breaking a previous record of 16. Seven of them were named Atlantic

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**Ad Design/Layout** ..... Nancy Rae Mallery, PJ Fischer  
**Printing** ..... Concord Monitor, Concord, NH using 100% recycled paper and plant-based, environmentally-safe inks.

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

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A Tribute to Carol Levin

We got the sad news that Carol Levin had passed on, one day after her 79th birthday, on December 26, 2020.

Carol was born on December 25, 1941 in Pittsburgh, the daughter of Herbert J. Levin, MD and Margaret Clara (Matuschak) Levin. After growing up in that city, she got degrees from Thiel College in Greenville, PA and from the D. T. Watson School of Physiatrists, at the University of Pittsburgh. She worked as a physical therapist at the Helen Hayes Rehabilitation Hospital in West Haverstraw, New York for two years before joining Project HOPE to help people in Nicaragua and Columbia. After that, she worked in healthcare in the Philadelphia area.

Carol had an interest in folk music, and helped organize the Philadelphia Folk Song Society's annual Folk Festival while she lived in that area. Because of her love of both music and Vermont, she soon moved here. In 1974, she opened the Chelsea House Folklore Center in a red barn in West Brattleboro, next to what is now the Chelsea Royal Diner.

The music venue, which operated until 1981, was the site of her wedding to Richard Gottlieb, in 1979. Richard was a delightful man, friendly to just about everyone he met. He was one of the earliest pioneers of solar electric systems. He installed solar cells on some of the satellites put into



Carol Levin and her husband, the late Richard Gottlieb. Courtesy photo from May 2016.

space by Vanguard rockets, the first of which went into orbit in 1958.

They lived in Guilford, Vermont, where she became known for the many activities she engaged in. She served on the Guilford Central School Board, was a trustee of the Guilford Fair, Inc. While she continued to work as a physical therapist, she increasingly took interest in renewable energy.

Together, Richard and Carol opened Sunnyside Solar to design and install solar photovoltaic systems. They sold their

first solar panel in 1983. One early customer of Richard and Carol was Pete Seeger, who used solar power to provide sound for Pete's Hudson River Revival.

Though Sunnyside Solar never grew very large, it had an important influence, as it promoted the use of solar systems for over thirty years, educating and advocating for clean energy. Because of this, Carol and Richard were given the Northeast Sustainable Energy Association Distinguished Service Award for their contributions to the solar energy.

Richard passed away in 2012. That sad event was covered by a G.E.T. article, "Green Guru" (<http://bit.ly/GET-g-guru>) which appeared in April of that year. Carol, however, was not deterred for long in her pursuit of solar energy. The article, "Sunnyside Solar Returns!" (<http://bit.ly/GET-s-s-returns>) appeared in August 2013, as she worked with

Cont'd on p.10

RECOMMENDED DOCUMENTARY  
I Am Greta

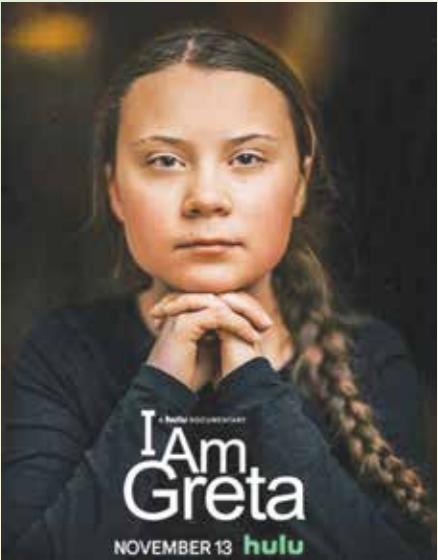
A Hulu Documentary

Film review by Victoria Ines

Starting at age 15, Greta Thunberg has worked tirelessly to stop and reverse the effects of climate change. And, in a way, it is absolutely unacceptable. A mere teenager should not have to keep the future of our planet on her shoulders.

Thunberg started her lonely journey outside the Swedish parliament building, hoping to bring attention to a topic that had plagued her for years. As a child, concern for the environment grew into a sort of panic, plunging her into a depression and a struggle with selective mutism. When she decided to take action instead, she was met with belittling and hostile reactions. Adults passing her on the street expressed their misplaced concern for her education and future, ignoring her attempts to explain that she had no future with climate change wreaking havoc in the world. She was ignored or worse, comforted with lies.

Even as she gained a following, mostly within the student population, leaders around the world smiled with feigned support. As they praised her, they turned around to drill for oil and refrained from taking any sort of useful environmental protection measures. Thunberg set out to give speeches all over Europe, calling out leaders for their ineptitude and telling anyone willing to listen to "panic." We ran out of time decades ago, and at this point, we have only a few years before the effects of climate change become irreversible. The time to be diplomatic has passed. Thunberg knows this. When her father commented that her words were "harsh," she simply responded with, "but it's true."



I Am Greta is a 2020 internationally co-produced documentary film directed by Nathan Grossman, following climate change activist Greta Thunberg. The film had its world premiere at the 77th Venice International Film Festival on September 3, 2020. It was released on Hulu on November 13, 2020. Image: Official release poster.

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Concentration of CO2  
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413.95  
parts per million (ppm)  
January 29, 2021

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# IMPROVE YOUR HEALTH: SUPPORT POLICY IN FAVOR OF HALTING CLIMATE CHANGE

Dan Quinlan

While the pandemic was the driving health story in 2020, it was not the only major global health story. From coast to coast in the United States, the health and well-being of hundreds of thousands of Americans was directly affected by climate change driven catastrophes – including massive forest fires, and unprecedented hurricanes, tornadoes and flooding. We're now learning firsthand why the World Health Organization has identified climate change and air pollution as the number one threat to health in the 21st century.

As we enter into the third decade of the century, we're certainly encouraged to see an incoming president who will quickly reverse many of the massively damaging environmental decisions of the outgoing administration. But we need to have our eyes wide open. We would be naïve to think the federal government is going to lead the U.S. out of the slow-burn environmental crisis. Looking backwards, from labor laws to ending slavery to voting rights, the states have always led the way forward. When the momentum swings far enough in enough states, the federal government follows.

The major global fossil fuel companies collectively take in trillions of dollars annually. (The revenue of the top 20 was \$3.9T in 2018.) To protect the status quo, these businesses strategically spend enormous sums lobbying the federal

government, while also throwing up carefully designed smoke screens about shifting their business models toward "clean" energy. Like the idea of "trickle-down economics," that idea stays afloat because many people are naïve about what actually drives modern capitalism – excessive growth and simple greed. In a nutshell, protection of an unsustainable status quo is why the Congress has been ignoring the science on climate change for almost 40 years. So, what's the answer? The answer is a rapid and unrelenting groundswell of support for the passage of smart policy ideas in towns, cities, and states.

The best way to learn about smart policy that makes sense where you live is to roam around on the websites of clean energy advocacy organizations in your state. Most of the people reading this probably know that here in New England, the two main sources of carbon pollution are transportation and heating and cooling buildings. If



Dan Quinlan gets help promoting his message to help our planet from his dog, Maple. Courtesy photo.

we don't handle those problems, the rest is moot. On the transportation side, the Transportation and Climate Initiative (TCI) ([www.transportationandclimate.org](http://www.transportationandclimate.org)) would bring billions of dollars into the clean energy economy in the northeastern part of the country. The governors of

Vermont, New Hampshire and Maine need to join the governors in the other New England states in signing on to TCI. At the other end of the transportation spectrum, Cambridge, Massachusetts now requires that gasoline pumps have a bright yellow sticker that states the burning of gasoline has "major consequences on human health and the environment including contributing to climate change." Simple, powerful idea. Why aren't we doing that everywhere? Similarly, there are plenty of equally smart legislative proposals on the building-energy side (many described right here in this issue of *Green Energy Times*).

Then what? Talk to a legislator in any

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New England state and you'll get the simple answer. Other than election day, the vast majority of people who think of themselves as caring about the environment are silent. Not that other voters are exactly knocking down legislators' doors. But, if you're a legislator and you hear from ten people who are against a new idea versus three people who support it, that's enough to make your decision.

It all comes back to a core value most of us share: the health of our kids and the people who live in our communities. For those of you who grieve about where things are headed on the environment, the way forward is simple. Reach out to local and state advocacy groups, learn what they are up to, and then support the high impact ideas. That's a prescription for personal mental health, and the health of our families and communities. Pure and simple.

Dan Quinlan is a consultant whose work focuses on the intersections of climate change, clean energy, community health and impacts on vulnerable populations. His work is a mix of policy and communication work for non-government organizations and financial and technical consulting services to health care system leadership teams. He is also the founder of SolaVida, a non-profit organization dedicated to expanding the community of people taking action to reverse global warming, promote clean energy, and advance the dialogue on climate change. Learn more at [www.solavida.org](http://www.solavida.org).

## EIA Projects Huge Decline for Natural Gas Generation

✓ Renewable energy and battery storage lead the country's new energy production

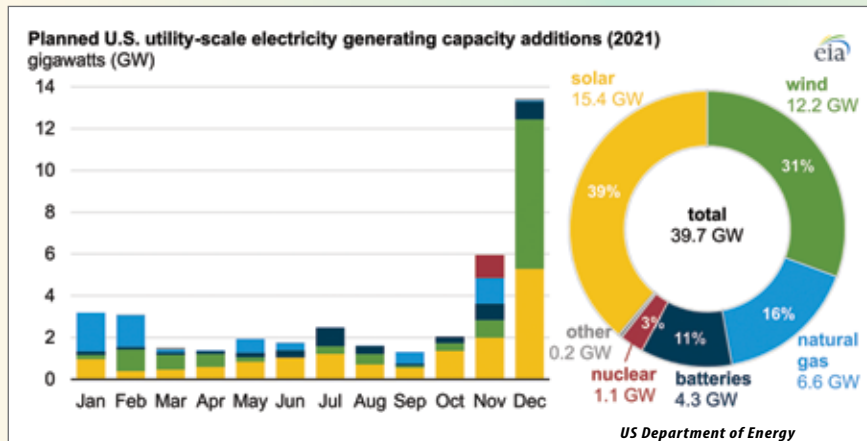
George Harvey

We have stunning news from the U.S. Department of Energy's Energy Information Administration (EIA). Admittedly, you have to look beyond the fluff to see it, but it is stunning nevertheless.

About two years ago, the companies that make turbines for natural gas plants were reporting a serious fall in sales. GE was suffering especially badly because it had misread the market. It had bet heavily on increased sales of turbines for natural gas power plants, because fracking had pushed the price of natural gas low. The trouble was that the low cost of gas did not translate into increased turbine sales.

Unlike GE, we at Green Energy Times had expected that the decline in turbine orders presaged a fall in natural gas capacity additions. (Please see "The End of Fossil Fuels is In Sight," <http://bit.ly/GET-goodbye-fossils>, in the June, 2018 edition.) We believed natural gas plants that were already on order would be completed to recover investments already made in them. But after that, new capacity looked very uncertain, because even with low gas prices, natural gas capacity was not competing well with renewables.

Now, in 2021, the EIA has sent out a report with projections on what electric generating capacity additions are expected for this year (<http://bit.ly/EIA-planned-capacity>). It shows that natural gas capacity additions are expected to be about 6.6 gigawatts (GW) in 2021, compared to 8.56 GW in 2019 (<http://bit.ly/FERC-dec-2019>) and 11.98 GW in 2017



11% of all capacity additions this year. We could look at the fact that this figure is getting close to the 16% expected to come as natural gas plants and loudly say, "Wow!" But before we do that (and get ready for this!), we should take note of the fact that on earlier charts, batteries do not appear at all. Batteries are a new entry this year, and

they are already challenging what was only recently the leader.

Solar power is expected to provide 39% of new capacity. Wind's share is to be 31%. Natural gas is number three at 16% (this does not include the loss of retiring plants). Grid-scale battery storage is to provide 11%. And nuclear is expected to come in at 3%. Since the batteries do not produce emissions and back up solar and wind power, we should probably include them among renewable resources. If we count them so, 81% of expected additions would be renewable.

What happens after this year is relevant. Laws of economics indicate that the cost of solar, wind power, and batteries will continue to fall, and with them the cost of the electricity they make. Over the next few years, natural gas will almost certainly find making money increasingly difficult. This year's additions were already in the works, and the ground was already broken for them. But in this market, it is hard to imagine any reason for anyone to invest in a new natural gas plant.

(<http://bit.ly/FERC-dec-2017>). Natural gas new- capacity additions have been falling at an average rate of 14% per year.

The reason for the slowing of natural gas installations is that renewable energy costs keep falling rapidly. Now, they are below the cost of natural gas in most places. Clearly, the gas industry is in decline, and it is likely to remain so in the long term.

This is where things get really interesting. Along with these changes, we now have a new factor exerting its influence. It is the growth of large-scale battery energy storage which can serve to keep renewable energy going constantly, whether the sun shines or not, and no matter what the wind speed may be. The cost of batteries has fallen 88% in the past ten years, according to a recent article at Ars Technica (<http://bit.ly/AT-battery-costs>). And now, energy from batteries charged by renewables is competing with the least expensive energy from natural gas plants.

To see how fast batteries are growing, we can go back to the graph the EIA used to illustrate its press release. We can note that battery storage is projected to account for

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# Running out of Gas

Robb Kidd

A week ago, I was writing an action plan to transition Vermont to a modern transportation system accessible to all Vermonters and is compatible with Vermont's climate goals when I received an emergency phone call from my wife. She had just run out of gas driving home on I-89. But having one family car, I had to scramble to find other transportation. Similar to that, we as a state are scrambling with an empty tank, but fortunately, we have solutions that don't rely on fossil fuels.

I live in Montpelier, and am surrounded by a walkable community. That is a privileged situation, because housing in Montpelier is at a premium, and there are limited jobs, so it is not an affordable option for all. Vermonters live in rural communities and drive many miles to provide for their households. How do we help those Vermonters and those who can't drive or even afford the expenses associated with owning a car? How do we reduce Vermont's carbon footprint? It is very fortunate that we can, and that it is within reach if we make investments today.

At the State House, Representatives McCormack, White, Burke, Stebbins, and Bartholomew just introduced the Transportation Modernization Act to invest in communities and make transit more accessible while being consistent with our climate goals. The ideas included are policies that Vermont has already enacted, and we need to make strategic decisions to use existing revenue. Furthermore, as Vermont is slated to receive millions of dollars of stimulus



2019 Drive Electric Week event at the VT State House. Courtesy images.

from the Federal government, it has to be prepared to seek viable solutions that are accessible to all.

**Vehicle Electrification.** A myth promulgated by those who oppose electric vehicles is that EVs are only for the wealthy. EVs' costs-to-purchase are higher, but EVs require less maintenance, reduce energy costs, and lower electricity rates<sup>1</sup>, while increased electrification creates local jobs. However, given that the initial costs are higher, Vermont has created two incentive programs to help lower these costs. The New Electric Vehicle Incentive Program administered by Drive Electric Vermont and the Mileage Smart Program administered by Capstone can exclusively help low-income Vermonters reduce their car costs. These programs can get more Vermonters into clean and modern cars — new or used higher-mileage vehicles.

At the same time, we need to rapidly in-

vest in a charging infrastructure especially for multi-family dwellings and workplaces. We also need to electrify all school and transit buses and include electric bikes. Incentives and grants to make infrastructure and all vehicle types affordable must be a part of any transportation modernization. Vermont can help the country reach the goals of the Paris Climate Accords with smart incentives.

**Transit.** It's also important to create diversified transit options that don't involve a car. Fare-free transit is an important policy. It removes financial impediments and makes it easier to access any transit route. A \$2.7 million dollar investment will remove those hurdles and make for seamless travel. The state needs to continue to invest in new routes, because fixed-route transit is not always accessible. Innovative micro-transit projects such as Montpelier's MY Ride program should be explored. Large employers should explore Transportation Demand Management programs to encourage tele-commuting, ride-sharing,

biking to work, or using public transit. To ensure all transit operations are linked, whether it is a bus, micro-transit, or passenger rail, establishing a centralized transportation authority is also being considered.


## Downtown Development and Bicycle- and Pedestrian-Friendly Communities.

Creating communities that are walkable and equally accessible for all Vermonters is very marketable for businesses, helpful for employers, and increases the general quality of life. With a focus on supporting downtowns, there would be less of a demand for single-occupancy motor vehicles. Helping to ensure roads are safe and comfortable for bicyclists and pedestrians will encourage better health and a greater connection to the community.

Vermont is already doing this. However, it is going to take greater investment. The Transportation Modernization Act calls for utilizing just over \$10 million dollars from current revenues to make these investments. This is a start and given the promise of the Biden Administration, there is a hope that Vermont will receive more federal dollars to invest in more for Vermonters.

Vermont is currently stuck in an antiquated transit system operating from the remnants of the dinosaur age. The potential is great for a new path. Nonetheless, we must think beyond roads and bridges, and think out of the box, or should I say out of the gasoline-powered automobile. We are metaphorically running out of gas, but instead of refueling, we can rebuild with a clean, modern, and equitable transportation system.

<sup>1</sup>Most EVs are charged in the evening. The energy purchased is mostly excess electricity that the utilities are unable to utilize. The utilities sell energy and profit over what would have been wasted (<http://bit.ly/EVsDriveElectricRatesDown>)

Robb Kidd is the Conservation Program Manager for the Vermont Sierra Club. He can be reached at 802-505-1540 or [robb.kidd@sierraclub.org](mailto:robb.kidd@sierraclub.org) 



# He's Upset about Electric Buses

George Harvey

There are some things that get me a bit upset. One of them is reading about electric buses (e-buses), and I am just itching to tell you why. Reports about the numbers of e-buses in the U.S. come up from time to time. Last October, for example, a report on e-bus market trends, "North America Electric Bus Market – Growth, Trends, and Forecast (2020 – 2025)," put the number of them in the U.S. at about 650 (<http://bit.ly/US-e-buses>). The number is increasing at a compound average growth rate of 26.76%, which means we might have a total U.S. fleet of over 2,000 in just under five years.

Let's consider how that compares with other countries. In August, shortly before that report was released, a story appeared at CleanTechnica about a transit company in Panama that had placed an order for 195 buses (<http://bit.ly/Panama-e-bus>). Because the country had Paris Accord goals, 35 of these buses were to be electric, and the rest would be powered conventionally. Getting wind of this, Chinese bus maker BYD gave the transit company two buses to test. After extensive testing, the transit company canceled the order for conventional buses and replaced it with an order for e-buses. The reason was that though e-buses cost a good deal more up front, they were so cheap to run that conventional buses made no sense.

In December, another article appeared about e-buses, this time in Columbia. This time, the article said that the city of Bogota

was getting 470 e-buses (<http://bit.ly/Bogota-e-buses>). Again, cost was a factor in going electric. Nevertheless, the buses are not cheaply equipped. They have TV, Wi-Fi, and USB ports so passengers can charge cell phones and more.

These are just two orders. The news has other large orders for e-buses come up regularly, with deliveries all over the world. But I picked these two as examples because these two orders, from two authorities in Latin America, are for a total number of buses that exceeds the number in the "greatest country on Earth." They are really great buses, and the purchases were made because their economics was sound. What does that say?

There are over 16,300 e-buses in Shenzhen. When I ask people whether they know where that is, very few say they do. (It is a city just north of Hong Kong.) There are over 500,000 e-buses in China, which has been developing the use of e-buses over the last five years. Electric buses are taking a powerful position in the world markets, and the United States does not even have its toe in the water.

I think it is time we free ourselves of the sort of thinking that holds back electric vehicles. A little study of the e-buses and their advantages helps with this.

Chicago started testing e-buses in 2014. It found that they saved about \$54,000 per year in fuel and maintenance costs, which means that their initial high cost would

be covered over their service lives (<http://bit.ly/Chicago-bus-fleet>). That, however, was 2014.

The high cost of e-buses was due to the high cost of the batteries needed to run them, and that cost has been in steep decline. Since Chicago got its first e-buses, battery prices have dropped from \$592 per kilowatt-hour to \$137, according to an article in arstechnica (<http://bit.ly/Falling-battery-costs>). The price of batteries is expected to continue falling quickly for years to come, as technology improves. And with the cost declines, e-buses are constantly getting more attractive economically. Estimates are that within five years, their initial costs will fall below those of conventionally powered buses, and at that point, buying a bus powered by gasoline or diesel oil will be a lose-lose situation.


The switch to electric vehicles of all sorts is inevitably on its way, because of economics that do not even have to figure in such social costs as healthcare associated



Electric bus in Krakow, Poland. Image: Solaris.

with pollution and climate change.

There are not many material barriers to overcome, the major one being a need for charging stations. We should ask ourselves why we cling to inferior, obsolete technologies in this country. My best guess is that companies whose business plans depend on fossil fuels are polluting our political system as well as our air.

As we go to press, we have learned that Bogotá, the capital of the South American country of Columbia, has recently ordered 1,002 more electric buses from BYD. So a single South American city has more electric buses on order than there are in the entire United States. 



# SMART COMMUTING IN NH & VT

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

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

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

In New Hampshire you’ll find a similar site at “NH Rideshare” where you can find car-pools, transit routes and schedules, bike and walk trails and links to statewide transportation information.

When carpooling, remember to use the local Park n Ride lots to meet your connections. Start your trip planning at [connectingcommuters.org](http://connectingcommuters.org) or [nh.gov/dot/programs/rideshare/](http://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](http://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](http://advancetransit.com)

**CARROLL COUNTY TRANSIT** - Services and connections to Belknap County. 888-997-2020 [tccap.org/nct.htm](http://tccap.org/nct.htm)

**CITY EXPRESS** - Serves Keene. 603-352-8494 [hcsservices.org/services/transportation/cityExpress.php](http://hcsservices.org/services/transportation/cityExpress.php)

**SCS TRANSPORTATION** - Services for Sullivan County.. 603-542-9609. [SCSHELPS.ORG](http://SCSHELPS.ORG)

**CONCORD AREA TRANSIT (CAT)** - Serves Concord 603-225-1989 [concordareatransit.org](http://concordareatransit.org)

**COMMUNITY VOLUNTEER TRANSPORTATION COMPANY (CVTC)** - serving 34 towns in the Monadnock Region, providing “no fee” transportation for people with limiting circumstances. 877-428-2882 x5. [CVTC-nh.org](http://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](http://cart-rides.org)

**DARTMOUTH COACH** - Services to Boston, Logan Airport and NYC 800-637-0123 [dartmouthcoach.com](http://dartmouthcoach.com)

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

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

**NH RIDESHARE** - Your Source for Transportation Alternatives. [nh.gov/dot/programs/rideshare/](http://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](http://vitalcommunities.org/transport/index.htm)

**VERMONT PUBLIC TRANSPORTATION PUBLIC TRANSIT** - Lists transit, ferries and more at [aot.state.vt.us/PublicTransit/providers.htm](http://aot.state.vt.us/PublicTransit/providers.htm)

**AMTRAK** - Long distance train service. Discounts for AAA members and student advance card. (800) 872-7245 [amtrak.com](http://amtrak.com)

**CHITTENDEN COUNTY TRANSPORTATION AUTHORITY** - Burlington bus service with links to Montpelier, Middlebury and commuter route to Milton. [cctaride.org](http://cctaride.org)

**CONNECTICUT RIVER TRANSIT** - Services in Bellows Falls and Springfield. [crtransit.org](http://crtransit.org)

**GO VERMONT** - Offers carpool matching and commuter connections in VT 800-685-7433 [connectingcommuters.org](http://connectingcommuters.org)

**GREEN MOUNTAIN RAILROAD** - Day trips from White River, Champlain Valley, Bellows Falls and Rutland. [rails-vt.com](http://rails-vt.com)

**GREEN MOUNTAIN TRANSIT AGENCY** - Local service in Barre, Montpelier, Grand Isle, Stowe and Lamoille. 802-223-7287 [gmtaride.org](http://gmtaride.org)

**GREY HOUND/VERMONT TRANSIT** - Long distance bus services. 1-800-231-2222 [greyhound.com/](http://greyhound.com/)

**LAKE CHAMPLAIN FERRIES** - Transport between New York and Vermont via Lake Champlain. 802-864-9804 [ferries.com](http://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/](http://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 [ridercrt.org](http://ridercrt.org)

**STAGE COACH** - Commuter buses from Randolph and Fairlee to Dartmouth, Local village buses. 800-427-3553 [stagecoach-rides.org](http://stagecoach-rides.org)

# THE “NEVER CHARGE” EV OF THE FUTURE

Henry Caldwell



The Aptera. Can you see the solar cells which are built into the hood and roof? Images courtesy of Aptera.

Just imagine the electric vehicle (EV) of the future. Park it in the sun, and you never need to charge it. Or charge it once and go 1,000 miles without another charge.

When will that be? A company called Aptera says it will be in about one year.

What if the car turned out to be beautifully sporty, with a top speed of 110 miles per hour (mph) and an acceleration that could take it from 0 to 60 in 3.5 seconds? What if it has a roomy interior and styling that will turn the head of almost everyone in town? And what if the future is close enough to reality now, that 3,000 have already been ordered?

Looking at their figures, it is clear that a range of 1,000 miles on one charge is a definite possibility. And the question of whether a car might never need to be charged is really only dependent on how it is driven. And when it comes to design, the photos should tell you.

It may be possible, but is it real? We might have a hint about the answer in the fact that Jay Leno already owns a prototype that was built several years ago, and though its drive system is entirely out of date, its overall design is fairly mature.

The Aptera was designed from the ground up for efficiency. Its shape was designed to have the lowest drag possible, and in that it seems to have succeeded. This is important, because at a speed of 50 mph about half of a car’s energy is used just pushing air around. Because of this, and other efficiencies, one measly kilowatt hour (kWh) of electricity is all it takes to drive an Aptera 10 miles at 50 mph.

The range of the Aptera is determined by the battery. It will come with four different battery sizes, 25, 40, 60, and 100 kWh, for ranges of 250 to 1,000 miles. A three-wheeled car, it can come with power given to all three wheels, or just to the front two, with the three-wheeled option having faster acceleration.

It may look like it is cramped and tiny, but it is said to be roomy. It has 25 cubic feet of storage in the back and quite a lot of room for the two people in it. It is nearly five feet tall, and it is 14 feet 4 inches long.

Because it has three wheels, it has to be registered as a motorcycle in most states. Because it has a fully enclosed cab, however, its occupants need not wear helmets, and it can be driven with a regular car license.

We might ask whether the Aptera points to a different future for driving. I

think the answer to that question is definitely yes. The Aptera has solar cells integral in its skin. Efficient designs have been around for a while. When Aptera combined solar cells and extreme efficiency, it showed it was serious about the design, pushing it to a limit no one else had yet achieved.

The Aptera with three-wheeled drive and 100 kWh battery is not what I would call cheap; it is priced at \$46,000. With two-wheel drive and a 25kWh battery, however, it is priced at \$25,900, and that does not include cost reductions for whatever incentives the buyer can get.

Now, you might ask, “What about this never-charge thing?” The Aptera has 700 watts of built-in solar cells, and that amount can be increased on special order. The company has an online solar calculator, which calculates the number of times you would expect to charge a car based on your driving habits (<http://bit.ly/Aptera-calc>). According to the calculator, an Aptera would put enough electricity into its batteries to cover an average of 25 miles per day in central New England without charging. Based on the available numbers, I would say this is entirely possible, though I would expect to charge it occasionally in the winter.

The next question might be, “Is this how we will drive in the future?” I think it is pretty clear that this is a real possibility. There are even a number of ways this can be done based on how a car is designed. In the case of the Aptera, car’s high efficiency came at a price, which was partly to limit it to just two people and partly to go to a design for extreme drag reduction. For another car, efficiency might mean a design for lower speeds and acceleration to keep energy use to a minimum.

I think it is pretty clear that the Aptera points to a future where things may be better.

Aptera’s web site is [www.aptera.us](http://www.aptera.us).

Henry Caldwell is a contributing writer for Green Energy Times. ☺





# THE MERITS OF HYBRID VEHICLES

Randy Bryan

First, happy new year to everyone. May you stay healthy, and let's all make 2021 better than 2020. I love seeing the advertisement where a person holds a coffee mug that says 2020 and shows a one-out-of-five satisfaction rating.

So, hybrids? Given the success of Tesla, battery electric vehicles (BEVs) are now the emergent form of transportation. Tesla has the product and direction every car original equipment manufacturer (OEM) is chasing: battery powered, the sensation of driving electric (quiet and power), the fuel cost savings (about half cost), maintenance savings (about half to one-third the cost), the charging infrastructure, and the hype.

Given all these benefits, why would anyone want hybrids or even plug-in hybrids? After all, they are more expensive to make (two propulsion systems), don't save any money in maintenance, and save less money on fuel (only partly offset with electric driving).

Well, it turns out there are many reasons. New Hampshire especially may be fertile ground for hybrids, since NH has done little to encourage BEV adoption. BEV enthusiasts may not endorse all the reasons, but they are perfectly valid to much of the driving public. I'll list a few reasons to encourage thought on the best way forward.

I'll start with legacy technologies' momentum: the car-fueling infrastructure is far superior in extent and speed to electric recharging, many people love (not just like) the association of noise with power, and the most credible new cars below \$40,000 are internal combustion engine (ICE) cars and some hybrids. We're used to the fuel and maintenance-activities costs, dealerships are dependent on internal combustion engine (ICE) maintenance revenues, the OEMs are dependent on selling big-iron (SUVs and trucks), and



A Ram plug-in hybrid electric vehicle (PHEV) being charged. Image: Flickr.

many people just won't accept change in some things.

So, if you are shopping for a car, what are your thoughts? Let's focus below \$40,000 as most people do.

**Cost:** A really good new or used ICE car cost in the \$13,000 to \$30,000 range. BEVs options cost more and are viewed as having short range (less than 150 miles), limited and poor charging infrastructure (combined charging stations and CHAdeMo fast charging), and uncertain longevity of the battery in particular.

But hybrids and plug-in hybrids have some merit here. New ones cost in the \$20- and \$30-thousand range, while used ones can be had down to \$10,000. They are generally well built (good for more than 200k miles), and 40 to 50 mpg isn't bad either, compared to 20 to 30 mpg for ICE. With a plug-in hybrid (PHV), you can also get the enjoyment and benefits of BEV driving for a limited distance. One friend went from 25 mpg to 250 mpg with his plug-in hybrid (mostly local driving). Need to go farther? Just fill up with gas. NH is especially notable as having a very scarce charging infrastructure when compared with the surrounding states. Sales of hybrids or PHVs are likely a more attractive option, here, than BEVs. (Pains me to say it!)

For these reasons, even as the global zero-emission vehicle (ZEV) mandates advance, most of the OEMs will favor hybrids and PHVs than BEVs as a transition technology. Some are still hoping hydrogen power will come to the fore, aided by considerable oil industry money and influence. The risk for the OEMs is that, if they misjudge the winning technology or the learning curve, they must license or buy technology (one foot in the grave), or partner or merge with other better-prepared companies (both feet in) to survive. That game isn't over yet.

If aftermarket service and customizations are your thing, ICE and hybrids have been easier to service and customize. The BEVs are more likely to be engineered as a closed system. Tesla is among the worst offenders in this category. Try to add an aftermarket product to a Tesla or take it to an independent garage, and Tesla may shut your vehicle down or refuse further inhouse service and updates.

So, I predict the market for hybrid and PHVs will have a resurgence as the OEMs churn them out, and the public and dealerships slowly absorb the fun and utility of EVs, especially in NH where there are no ZEV mandates and the CCS (non-Tesla) charging infrastructure is so scarce. I see hybrids and PHVs as a good transition technology and psychology for the mass market. Be kind and encouraging to those



**Hybrid Power to House Power**  
PlugOutPower.com

who go hybrid, as they absorb the future at their own pace.

Again, enjoy your 2021 experiences and stay safe.

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

## One Advocate's Energy Plan Electrifying Energy Needs

Wylton King Fishman

The 2020 New York State Renewable Energy Summit ended with a mission statement: "Does your town have an energy plan?"

All the solar installers agreed New York State could install far more renewable energy if the barriers would fall a bit rather than creep up and up as they have over the past two decades. Solar developers spend thousands of dollars to prepare engineering studies. As they come forward to the town for a permit, a town can implement home rule and say no to solar. In addition, our old transmission infrastructure needs updating and the renewable energy installers have to pay to upgrade equipment. (This is the plan nationally, too.) New York's leading solar developers won't be here much longer. Demand is great, costs keep plummeting, but the state has barriers and the margins are under attack.

News flash! All of the software tools exist to manage the grid: sun, partly cloudy, wind, no wind. No fear! The New York Indepen-

dent Systems Operator wants more "no fuel" power generators to place first on its daily auction.

It takes 4.5 to 7 acres to build one megawatt with solar modules. Megawatts of solar farms won't happen in our densely populated city. One elevator cannot be supported by the solar system on an apartment roof. We need wide open spaces, and they are all upstate except for the Atlantic Ocean.

Here in the city, we can barely comprehend how energy wasteful it is to have puffy black smoke from untweaked boilers, air conditioners hanging out of windows in winter and old-fashioned lighting in the back hall. These three energy gobblers set our buildings high on a fat pile of energy wastefulness. An infrared camera will expose heat escaping a building on a night when the building is about 20 degrees warmer than the outside air. It's as obvious as those windows we see open in winter. We benchmarked our buildings and turned around and said, "It costs too much"

Cont'd on p.36



## We Dare You to look under the Hood!

➔ **\$1,000 electric vehicle rebate**  
➔ **\$300 residential charger rebate + off peak charging rates**  
➔ **\$2,500 commercial charger rebate**



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# CLEAN ENERGY NH ANNOUNCES 2020 AWARD WINNERS

Clean Energy Champion of the Year, Clean Tech Business of the Year Awardees Recognized

Clean Energy NH, the Granite State's leading clean energy advocate and educator, announced the winners of its annual Clean Energy Awards via virtual means this year due to the pandemic.

Competition for the awards is stiff every year because members of Clean Energy NH represent the state's most distinguished clean technology companies ranging from renewable energy generation, engineering, consulting, energy efficiency, legal, financial, and beyond. In addition, the individual members of Clean Energy NH are well-known for their extensive contributions to the state's policy, regulatory, and municipal landscapes.

The Clean Energy Champion of the Year Award was established in 2017. The award is presented annually to a Clean Energy NH member who has gone above-and-beyond in their support and engagement with the organization and demonstrates a leadership role in the transition to a clean energy future.

Few individuals have done more for the progress of our state's, nay, our nation's energy evolution than this year's winner. Clifton Below, in the mid-1990s as a legislator in New Hampshire's House of Representatives, penned the nation's first Electric Utility Restructuring Statute and catalyzed a wave of copycat laws across

America. Since this auspicious start to an illustrious career, Clifton has continued to lead New Hampshire forward on energy issues -- first as a State Senator, then as a Public Utilities Commissioner, and now as Assistant Mayor for the City of Lebanon -- always with an unshakable commitment to the ideals of market competition, energy independence, and environmental sustainability. A smattering of Clifton's accomplishments over the years includes his co-founding of the Regional Greenhouse Gas Initiative, his collaboration with Liberty Utilities to design a nationally recognized time-of-use residential energy storage pilot, and most recently authoring and shepherding the Community Power Law through the New Hampshire General Court.

The Clean Tech Business of the Year Award was also established in 2017. This award is presented annually to a Clean Energy NH business member that demonstrates excellence in their clean tech industry sector and continues to support the work and mission of Clean Energy NH



Above: Clifton Below.

Right: Representatives of Resilient Building Group with the Clean Tech of the Year award: Dana Nute (left), President and Chase Pennoyer (rt), VP of Operations. Courtesy photos.



through their engagement with the organization and their commitment to their work. This year's winner is Resilient Buildings Group, based in Concord.

One needs only to enter the Resilient Buildings Group office, where a collection of LEED certificates from past projects stretches floor to ceiling, to witness their commitment to high-performance buildings and energy efficiency. Their dedicated staff has assisted clients across New Hampshire, from Holderness and Derryfield Schools to Grappone Auto, Ava

Gallery and Art Center, and even Lindt. From simple energy audits and benchmarking to advanced LEED consulting and custom energy services, the team at Resilient Buildings Group works with clients to improve their buildings and take advantage of the state's energy efficiency programs and rebates. Resilient Buildings Group has been a longtime member of Clean Energy NH and continues to do great work across the state, even during the challenges of the 2020 pandemic.

Dana Nute, President of Resilient Buildings Group, says: "My team at RBG envisions a region in which new and existing structures become resilient, high performance buildings: energy efficient, comfortable, durable, cost effective to operate, healthy, and safe. It has been an uphill climb, but we have been making great strides over these years on a wide range of sustainable projects. We are committed, and shall work tirelessly to continue to meet our goals. By accepting this award, I would like to say that we look forward to a future of working with like-minded clients and energy partners to meet the goals of reducing greenhouse gas emissions."

Clean Energy NH's mission is to promote clean energy and technologies through education and advocacy for a stronger economic future. Learn more at [www.cleanenergy-nh.org](http://www.cleanenergy-nh.org). ☺

## 2020 Warmest Year on Record

Cont'd from p.1

storms, three were tornado outbreaks, two were severe hail storms, eight were other severe weather events, one was a drought, and the fires in the western U.S. counted for one ([www.ncdc.noaa.gov/billions](http://www.ncdc.noaa.gov/billions)).

With 22 billion-dollar events, 2020 was the sixth year in a row having ten or more. The period of 1980 to 2000 had an average of seven per year. The total cost of weather-related disasters is more than double the average for the last 41 years. We were lucky, because for all the storms we had, none hit a major city. The damage could have been far worse. Nevertheless, the effects on our economy are growing rapidly.

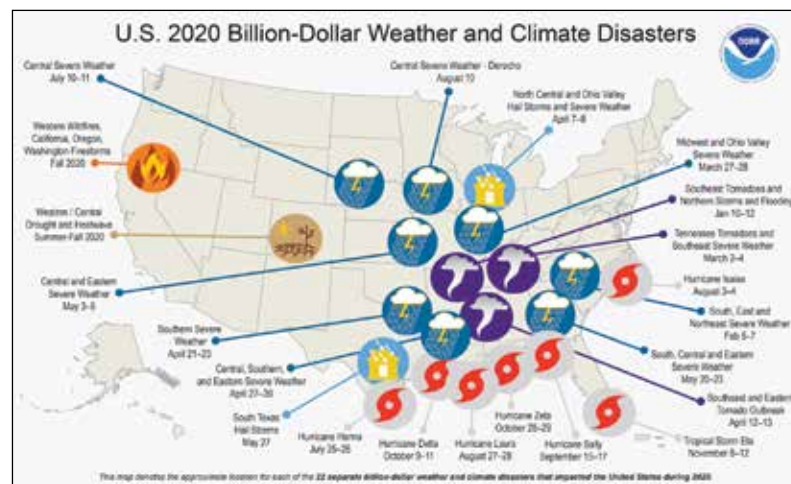
One more thing NOAA made clear is that the economic cost of climate change is increasing rapidly. The cost of weather disasters in the 1980s averaged \$17.8 billion, adjusted for inflation. Since then, it has risen consistently. Over the last five years, it averaged \$121.4 billion.

Other parts of the world also have problems, of course. The last intact ice shelf in the Canadian Arctic collapsed, losing an area bigger than Manhattan because the sea and

air were both unusually warm. Unfortunately, what is "normal" is changing.

The cause of the increase in big, damaging events is a seemingly small increase in global temperatures that is still less than the 1.5°C we have set as a limit to avoid dangerous climate change. Unfortunately, 1.5°C is a temperature rise we are rapidly approaching and soon will pass. As we put more carbon dioxide, methane, and other greenhouse gases (GHGs) into the atmosphere, the temperature of the Earth's surface goes up.

Michael Mann is the scientist who showed us the "hockey stick curve" in a paper published in 1999. He is also known for testifying before a congressional committee that the consensus that climate change is real is the same among climate scientist as the consensus that gravity exists is among physicists.

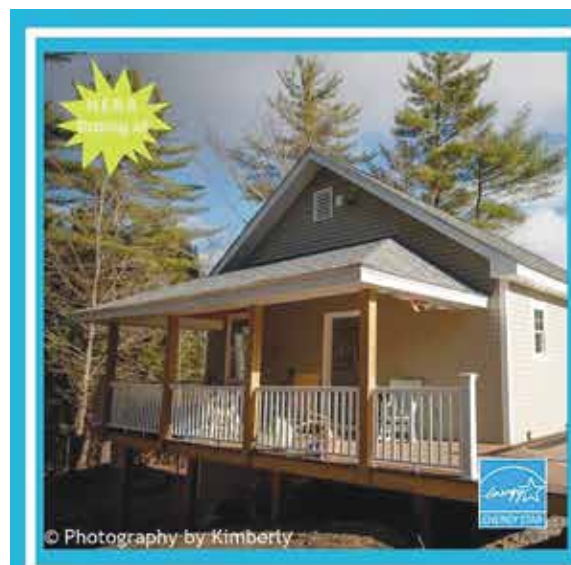


Now, Mann has addressed a real difference of opinion among climate scientists. While many say that the Earth will continue to heat up for decades or centuries after we stop emitting GHGs, Mann asserted in an interview with The Guardian last October that he was confident climate change will slow down very quickly once we stop emitting GHGs, provided we do it soon enough. Please note two things, however: We must

act soon enough. And acting will stop things from getting worse, not reverse the damage that has already been done (<http://bit.ly/Guardian-Mann>).

There are scientists who disagree with Mann, but he might be right, and that gives us hope. Even if he is wrong, we have to act to prevent the worst of climate change. If we get very proactive about eliminating GHG emissions, we really might be able to save the planet, and our children's futures with it. But to do that, we must act quickly.

To stop climate change, we need to free ourselves from fossil fuels, which means using electric vehicles and heat pumps. The electricity we use will have to be from renewable sources and technologies. We need to stop using plastics based on petrochemicals. We can choose low impact clothing, food, and other goods. We have to support the legislation it takes to get there. We have to do these things as quickly as possible. ☺



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# Small Solar Saves Everyone Money – Yes, “Everyone”!

George Harvey

All solar photovoltaics (PVs) have one very special characteristic. While they only produce electricity during daylight hours, they also produce at just the time electricity demand is at its highest. This is particularly important because they replace the most expensive electricity we have with the cheapest electricity available. But also, small, “behind the meter” (BTM) solar power also reduces the peak load of electricity transmitted during a year, and that reduces the transmission costs for all of New England’s electricity customers, all the time, day and night, all year. This part of the energy mix includes any PV system that is grid-tied but does not participate in the grid market. The owners of such systems are called “prosumers” because they produce and consume grid electricity. They use their own power much of the time instead of sending it to the grid, so usually there is no record of how much was generated.

These savings, as important as they may be, are not the end of the story. Solar power replaces grid power that would be generated from fossil fuels, and that reduces societal costs, such as those relating to healthcare and climate change. BTM solar plants increase the tax bases for some communities, saving other taxpayers money. And they offer employment, an additional benefit.

Because of these savings, everyone



Solar array on MassDOT Highway Division office property in Northampton, MA. MassDOT photo.

benefits from the addition of BTM solar PVs, whether they go on a factory rooftop or in someone’s back yard. The big question a lot of people might have is, “How much?”

The cost benefits of BTM solar power are not easy to calculate. It would be hard to guess how much solar power has reduced costs in the New England states, but now we have a resource that explains it. Synapse Energy Economics (SEE) has published a report, “Solar Savings in New England,” which examines the effects of BTM solar power in the six New England states over a six-year period, including the years 2014 through 2019 (<http://bit.ly/SEE-2014-2019>). The savings are impressive.

Just from BTM solar power alone, New England electricity consumers saved \$1.1 billion during the six-year period. Of course, the largest share of that went

to the owners of BTM systems. But as we have seen, these systems reduced grid costs and transmission charges during peak periods, so a significant share of the savings went to every ratepayer.

The SEE report breaks down the cost savings for each state over the six years. Connecticut saved \$260 million. Maine the least, at \$68 million, and Massachusetts saved the most, at \$513 million. New Hampshire saved \$83 million, Rhode Island saved \$58 million, and Vermont saved \$79 million.

While the savings for states varied to a degree by population, they also varied according to the amount of BTM solar capacity installed. We note that the greatest saving per person was for the state of Vermont, where savings came to \$126.60 per person over the six years. If that seems a small amount, remember that this is not utility-scale solar, it is BTM solar, largely


on people’s rooftops and in back yards. Also, it represents the average of all savings, including everyone who does not have a PV installation. In other words, the small solar systems a few of us own are creating a significant positive impact for everyone. And that is a big story.

Another aspect of all of this is that the benefits of PVs do not end with the prices for electricity, and BTM systems save in ways that are not represented in the data we just saw. The SEE report addresses these in its coverage of two important areas. One is healthcare. Based on data from an EPA assessment of healthcare

impacts during the same six years, the SEE report concludes that BTM solar saved New England residents \$87 million during that time.

Savings from offsetting carbon emissions are much harder to calculate. We can take any of a number of costs of these emissions. The SEE report makes this clear, and cites three numbers for savings. They range from a low of \$515 million to \$1,948 million.

Combining these numbers still does not tell the whole story, but it does put a value on the modest solar arrays we see around us. Taking the lowest savings values, they are pushing \$300 million per year for New England. With the highest values, they would be worth well over of \$520 million.

Generally speaking, BTM systems are small. But taken together, they are significant in big ways. 

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# Bhima Nitta Had a Dream...

## Power Guru Reaches Bhima's Goal, Carrying on His Legacy

George Harvey

In the September edition of *Green Energy Times*, we noted the passing of Bhima Nitta. He was a man who worked passionately to address the climate crisis. His passing at the age of 54 is sad and leaves us with a feeling of emptiness. Bhima Nitta, however, left us a legacy that is being carried on by others. Power Guru, the solar developer Bhima founded, is continuing without his day-to-day presence and is keeping up the momentum of solar installations.

We recently received an update on how the company has been doing, pursuing his long-term goals. It seems that Bhima set it up quite well to continue with its climate goals, and this can be seen in performance numbers for the year. Bhima Nitta had a goal to install 336 kilowatts (kW) of solar photovoltaic (PV) panels in 2020. The amount actually installed surpassed that goal by a wide margin.

During the course of the year, Power Guru installed a number of small systems, and these came to 69kW. Along with these, however, were three large systems totaling 345kW, clearly exceeding the goal. These three large systems are worth describing.

One of the large systems was installed at AQX, an airport in Bennington, Vermont. This system has 100kW of solar panels, which are on the roof of a hanger. The purpose of the installation was to reduce both the airport's utility bills and its carbon footprint. With planning, it became apparent that AQX could have an array larger than it needed to provide the airport's power, so AQX entered into an agreement on net metering with the Second Chance Animal Hospital, to the benefit of both organizations.

Another of the large systems Power Guru installed last year was for T&M Enterprises, a plastic injection molding company in Shaftsbury, Vermont. Injection molding is dependent on electricity for heating the plastic, and it can be a big draw on the power grid. Because



<< One of the two solar arrays installed at T&M Enterprises in Shaftsbury, VT. This array, located in Bennington, produces the majority of the power while a smaller roof-mounted array accounts for the rest. Combined, the two arrays have a capacity of 180kW. Photo: Karen Jernigan.

>> One of four new buildings in the Lake Paran Village, Bennington, VT. Each building is equipped with its own solar arrays to power the apartments within. Courtesy image. >>

of that, T&M was facing high electricity bills, and it decided that solar PVs offered a solution to that problem. The system was installed as two arrays. One is a large array on a roof of a building. The other is an even larger array set up as a ground mount. These two arrays of solar panels have a combined capacity of 180kW. T&M Enterprises has put a photo of its solar array up at its website tandmplastics.com.

The third of the large systems Power Guru installed in 2020 was for Shires Housing, a non-profit housing organization in Bennington, VT. A solar PV system was set up for a new housing project, Lake Paran Village, which was completed in September. The twenty-two living units were set up to be efficient and comfortable places for people to live, with heat, hot water, most appliances, and hookups for washers and dryers. These apartments are powered by a 65-kW rooftop solar system.

Power Guru used Hanwha Q-Cells for all three of the large systems listed here. The inverters and optimizers are Solar Edge products.

These projects are not all that Power Guru has been doing. Other projects are under development, and one of these is particularly noteworthy. Vermont Mill Properties occupy 12.5 acres of land, with about 215,000 s.f. of interior space that it

rents, primarily for offices and storage. The result of activity at the site is that it needs quite a lot of electricity.

Power Guru started development work on a solar array for Vermont Mill early in 2020. It is to be a 220-kW array installed on the rooftop as a Community Solar Project. All customers of Green Mountain Power can buy shares in this system and will get their power once it is complete. Work has been slowed because of Covid-19 regulations and the lockdown, but the system will hopefully be online soon.

Clearly, the dream of addressing climate change by bringing solar power to people, a dream that Bhima Nitta made into a reality, is still doing good in this world.

Learn more at [power-guru.com](http://power-guru.com). ♻️

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The AQX airport in Bennington installed a 100kW rooftop solar array on a hanger. The electricity produced supplies the airport as well as the Second Chance Animal Hospital. Photo courtesy Power Guru.

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# Saxtons River Solar Becomes Ridgeline Renewables

George Harvey

For a small company, Saxtons River Solar Electric (SRSE) shows up on our pages quite a lot. We published several articles about this innovative company and numerous others that mention it. There will very probably be more in the future, but the same company will be called by a new name, Ridgeline Renewables.

For as long as it has been running, SRSE has been a family business operating in Westminster, Vermont, near Putney.

The company has been owned and operated by Eric Shenholm, whose experience with solar energy dates from the 1970s. Now, the company is being passed to another member of the family, Anya Bredbeck, Shenholms's daughter, who has been working professionally in the trades since she was seventeen. She has been a SRSE employee for five years. And now, she is taking over ownership and operations.

Anya Bredbeck's brother Yuri Bredbeck is being brought onboard



A Ridgeline Renewables' solar installation in Vermont—solar with a view. Photos: Ridgeline Renewables.

to manage the office while Anya works in the field. With Covid-19, Yuri's office is in his own home. This is not just a precaution for the sake of health in times of the pandemic, and it will probably be an ongoing business plan.

SRSE's new name, Ridgeline Renewables, is part of the changeover. Aside from

what we have already listed, however, there will be very few changes in the SRSE business, and Yuri emphasized that the business will be much the same as it has been. It is true that Eric Shenholm is retiring, but Anya Bredbeck has been working at the company as the lead installer of heat pumps and solar energy for five years, after acquiring years of experience elsewhere. And, like her father, Anya Bredbeck is EPA-certified in heat pump technology. Chris Clay also remains on the team as an installer.

Ridgeline Renewables will continue its work on both solar power and heat pumps and will continue to sell and install the same products. They will honor the warranties of SRSE and will continue to service customers in the same ways. The company's territory will remain what it had been, keeping customers mostly within an hour's drive of Westminster.

The Ridgeline Renewables office number is 802-387-0073. Its web site will be [ridgelinevt.com](http://ridgelinevt.com), though [saxtonsriver solar.com](http://saxtonsriver solar.com) is working for now. Email is [ridgelinere-newables@gmail.com](mailto:ridgelinere-newables@gmail.com). ♻️



Father and daughter, Eric Shenholm and Anya Bredbeck.

## A Tribute to Carol Levin

Cont'd from p.2



Carol with Dave Bonta at Sunnyside Solar, Brattleboro, VT. Image: Green Energy Times, Oct., 2013

Dave Bonta, founder of USA Solar Store, to bring the business back to life.

Carol was passionately involved in clean energy, campaigning to eliminate energy sources that were polluting or dangerous. She was a board member for the New England Coalition on Nuclear Pollution, and provided leadership there and wherever else she thought it would do the best. And she was a wonderful friend to us at *Green Energy Times*.

Carol Levin was a woman whose life was filled with her many works, and who filled the lives of others with their benefits. She was survived by a large family and many, many friends. She will be greatly missed. ♻️

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# How Lithium Iron Phosphate Batteries Are Easier on The Environment

Danielle Ferguson

Lithium iron phosphate (LiFePO<sub>4</sub>) batteries have many features that make them superior to other battery technologies. They are lightweight and versatile. They have a long lifespan and a fast recharge rate. They can also withstand cold, heat, collision, and mishandling during charging and discharging without risk of combustion.

## But are lithium iron phosphate batteries environmentally friendly?

Manufacturing batteries does require energy and resources. But lithium iron phosphate batteries have several advantages over other technologies in terms of resource consumption and safety, and they have great potential to help reduce carbon emissions when used in wind and solar power systems. Let's take a look at a few of the environmental benefits of using LiFePO<sub>4</sub> battery technology.

## Enabling Electricity Storage in Renewable Energy Systems

When it comes to generating electricity with minimal carbon emissions, it's hard to beat wind and solar power. Solar power has especially taken off as the cost of solar has dropped more than 70% since 2010. But the wind doesn't always blow, and the sun doesn't always shine, which means practical off-grid or partially off-grid solar systems need to have batteries to store and smooth out the supply of electrical power. LiFePO<sub>4</sub> batteries are ideal for energy storage in solar photovoltaic systems, and they have several practical and economic advantages over lead-acid batteries or other lithium battery technologies, including:

Maintenance-free operation, with no need to monitor or top up water levels;

Partial state of charge (PSOC) tolerant, which means if operated in PSOC there is no damage (this is one of the leading causes of early failure of lead-acid batteries);

A much longer life span compared to lead-acid batteries (up to ten times longer), and a lower overall cost of ownership;

A 25% to 50% higher capacity than lead-acid batteries, with full power available throughout discharge;

Fast recharge times and a 99% efficient recharge process, which means



less wasted electricity;

A low rate of self-discharge (loss of stored power without a load), which means a long shelf life, up to a year, between charges.

And perhaps most important, LiFePO<sub>4</sub> batteries are inherently stable and non-combustible, and they are free from dangerous and messy outgassing, fumes, and leaks.

## A Recyclable Alternative to Lead-Acid Batteries

The disposal or recycling of batteries remains a key environmental issue. More than three million tons of lead-acid batteries are discarded every year. Some are safely recycled to recover the lead and other materials. But many lead-acid batteries end up in landfills, especially in developing countries, and toxins can cause fires and explosions and poison food and water supplies for generations.

With electrodes made of non-toxic materials, lithium iron phosphate batteries pose far less risk to the environment than lead-acid batteries. They can also be recycled to recover the materials used in their electrodes, wiring, and casings. Some of this material can be used in new lithium batteries. Even now, buyers can choose to buy LiFePO<sub>4</sub> batteries made from recycled materials.

The long lifetimes of lithium batteries used for energy storage and transportation mean that many of those made to date are still in use, so recycling processes are still in their infancy. As more lithium batteries reach their end of life, recycling will become more efficient as engineers improve processes to recover key materials.

## Inherently Stable and Non-Toxic Chemistry

There are big environmental advantages to using lithium iron phosphate batteries over lead-acid batteries. But how do LiFePO<sub>4</sub> batteries stack up against other types of lithium batteries in terms of environmental friendliness?

Quite well, it turns out.

Lithium itself is not toxic and it does not bioaccumulate like lead or other heavy metals. But most lithium battery chemistries use oxides of nickel, cobalt, or manganese in their electrodes. Estimates suggest it takes 50% more energy to produce these materials compared to the electrodes in lithium iron phosphate bat-

teries. A 2013 report by the EPA revealed lithium-based batteries based on nickel or cobalt have the highest environmental impact including resource depletion, ecological toxicity, and human health impacts, all almost entirely due to the production and processing of nickel and cobalt.

LiFePO<sub>4</sub> batteries, by contrast, have big advantages over other lithium chemistries:

They use no rare earths or toxic metals and employ commonly available materials including copper, iron, and graphite.

Less energy is consumed in mining and processing of materials.

Phosphate salts are also less soluble than metal oxides, so they are less likely to leach into the environment if the battery is improperly discarded.

And of course, LiFePO<sub>4</sub> batteries are chemically stable against combustion and rupture under nearly all operating and storage conditions.

Once again, lithium iron phosphate batteries come out ahead.

## An Environmentally-friendly Battery Technology

While it does take resources to produce practical and efficient batteries, not all battery technologies are created equal.

Lithium iron phosphate batteries not

only have superior operating characteristics compared to lead-acid batteries, they're also far less toxic to produce and recycle.

Compared to other lithium battery technologies, LiFePO<sub>4</sub> batteries use more abundant and non-toxic materials that can be produced with less energy.

And most promising of all, the performance and safety of LiFePO<sub>4</sub> batteries make them a superior choice for electricity storage in zero-emission renewable-electricity wind and solar power systems.

We're all concerned about protecting the environment, and we strive to do our part to reduce pollution and resource consumption. When it comes to choosing a battery technology,

lithium iron phosphate batteries are an excellent choice for enabling renewable energy like wind and solar and for minimizing the consequences of resource extraction. As lithium iron phosphate batteries become more widely adopted, the benefits of this technology for the environment will continue to grow.

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# Mobile Energy to the Rescue

Green Energy Times Staff

There are lots of reasons to have mobile solar systems complete with batteries. They can supply electricity when the grid is down, or where there is no grid at all, and they can supply it on an emergency short-term basis or for much longer times. Applications include construction sites, micro-grid applications, mining operations, and emergency response teams.

Great Canadian Solar (GCS), based in Edmonton, Alberta has introduced its Solar Sea Can (SSC), a mobile, compact, and flexible off-grid solar energy system. For those who don't know, "sea can" refers to cargo containers, also known as shipping containers. Sea cans can be moved easily and quickly, and the SSC is packed with solar panels, batteries, and other equipment to set up a small microgrid wherever and whenever it is needed.

GCS was founded in 2009 and has installed 70.0 megawatts of solar photovoltaic (PV) systems for residential and commercial customers. With that experience, design of the SSC was not a big problem. Clearly, however, it can be a solution for many problems that might arise, big or small. Companies can rent SSC to power office trailers, lighting, security systems, and other critical tools,

so they can avoid using gas-fueled generators.

As Great Canadian Solar developed the SSC, it became clear that the battery storage system had to be right. "We needed a battery storage system that has a smaller footprint than traditional systems and is easily transportable," said Csilla Harsasi, Renewable Energy Technologist and Technical Lead on this project. "Because Solar Sea Can operates in remote areas, it was important for the battery storage to be environmentally friendly and durable – something that could stand up to a little



Above: The Solar Sea Can Solution by Great Canadian Solar is a highly mobile, compact and flexible off-grid solar energy system for any remote power requirements. Right: Fortress batteries and solar components inside the mobile container. Images: Great Canadian Solar.



abuse."

Harsasi decided on lithium ferrophosphate (LiFePO<sub>4</sub> or LFP) chemistry to maintain high round-trip efficiency during the solar charge cycles. She found that Fortress Power offered batteries that were a perfect fit for the SSC.

GCS started with a small SSC, a nine-foot off-grid container. Success with that led to development of a higher-capacity, 20-foot container with 16kW of PVs and 30kW of storage. This larger unit has two Outback Radian GS8048A (8-kW) inverters and two Fortress Power LFP-15 batteries. "Because Fortress Power battery

storage is so compact, we can use any pickup truck to bring it to a job site, where it can be quickly charged and discharged," Harsasi said.

Customers were amazed at how well the system worked, even during frigid winter months. In fact, SSC with Fortress


Power battery storage produced an average of 839 kilowatt-hours of solar energy per month from January to March. The SSC system can be used to replace generators powered by fossil fuels, often eliminating the use of fuels altogether.

Great Canadian Solar found that there was more to Fortress Power than its batteries. GCS was impressed by the support and training provided by the Fortress Power team. "Besides having great products, Fortress Power has great technical support," Harsasi said. "Because Fortress Power has been very proactive about making sure their battery systems are compatible with major solar manufacturer solutions, there's less work getting the unit up and running on job sites. We haven't had this kind of experience with any other company."

Solar Sea Can systems have been in use in the field for a year and a half, often on construction sites. They have proven more reliable, cost-effective, and portable than traditional generators. Among their other advantages are the following:

- They are compact, highly portable, and easily set up.
- They can be set up just about anywhere.
- They provide reliable electricity around the clock.
- They can be 100% renewable, optionally.
- They are free of noise and emissions.

Great Canadian Solar's website is [greatcanadiansolar.com](http://greatcanadiansolar.com).

Fortress Power's website is [fortress-power.com](http://fortress-power.com). 

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# First-of-Its-Kind Community Solar Project CHARLESTOWN, NEW HAMPSHIRE

Steve Snyder

A first-of-its-kind community solar-electric project located in Charlestown, NH was completed in December 2020. This project allows member-owners to receive on-bill credits for their ownership share of the solar array's net-metered electric output each month. The Charlestown Community Solar project is 100kW AC. It is expected to generate approximately 184,000 kWh annually along with a considerable reduction of their carbon footprint.

Lorraine Kelly, one of the members of the project, said, "Larry and I are delighted to know that Charlestown Community Solar is fully operational and that going forward, five-eighths of our anticipated energy needs will be generated by solar power. Since we are surrounded by lovely old oak trees, rooftop solar was not an option for our total-electric house and plug-in vehicle. Being part of a community-solar project will enable us to reduce our carbon footprint significantly. Many thanks to you and the team at Norwich Solar Technologies (NST) for the fine work that made this choice available to us."

Group net metering has been available in New Hampshire for a few years, but only recently could participants



The 100kW AC Charlestown Community Solar project is member-owned and a first-of-its-kind for New Hampshire. Image: Norwich Solar Technologies.

receive credits on their electric bills directly. This new way for NH residents to benefit from solar stems from recent changes enacted by the state legislature. With this legislative change, NST was able to offer New Hampshire residents an easier way to participate and save by utilizing the on-bill credit method.

With the help of Sustainable Hanover's 2020 Solarize Hanover campaign, NST was able to help nineteen Upper Valley residential customers go solar, when they could not do so on their own homes for

a variety of reasons. According to the National Renewable Energy Laboratory, only 22 to 27% of residential rooftops in the U.S. are able to host a solar PV system because of structural challenges, tree shading, or "ownership issues" – mainly households who rent and cannot install solar panels on roofs they don't own. Community Solar is a way to overcome all of those challenges and grant solar access to a previously underserved population.

Each of the nineteen member-owners

in the project owns a specified number of panels sized to match the owner's electric consumption. By bringing the owners together as a part of a larger community project, the member-owners can benefit from the efficiencies of a larger array, achieve their desired result of going solar, and work around the challenges of having the panels mounted directly on their home.

The Charlestown Community Solar project is the first of many that NST plans to develop and construct in New Hampshire, in addition to the many ongoing community solar projects already in development in Vermont. Jim Merriam, CEO of NST said, "We are so excited how this new opportunity makes it easy for New Hampshire residents to benefit from solar. We think everyone has the right to choose how they get their power, and we hope this is just the beginning for New Hampshire residents."

For more information about the Charlestown Community Solar, contact Kevin Davis at (802) 359-7405, [davis@norwichsolar.com](mailto:davis@norwichsolar.com). Norwich Solar Technologies' website is [norwichsolar.com](http://norwichsolar.com).

Steve Snyder is the marketing director at Norwich Solar Technologies. ☕

## Keene Housing Expands Solar a Third Time, Advancing Clean Energy

Access to solar energy is expanding once again for those in need in New Hampshire's Monadnock region. In 2018, Keene Housing (KH) added solar arrays to its Harper Acres property. In 2019, in the second round of clean energy transitions for the affordable housing nonprofit, grid-tied rooftop solar arrays totaling 260.33 kilowatts were installed at Forest View Apartments along Harmony Lane. And in 2020, the third solar project at KH was wrapped up. A 98-kilowatt array was just installed on the roofs of Keene Housing's North Street and Gilsum Street Apartments.

Similar to the previous two arrays, the North and Gilsum project was installed at no upfront cost to Keene Housing.



Solar PV for Keene Housing now totals 260.33kW's. Image: ReVision Energy.

This solar panel project contributes to Keene Housing's long-term goal of relying 100% on renewable energy by 2035. Keene Housing's energy efficiency and production strategies align with a Keene City Council resolution that encourages the city and its residents to eventually generate

100% of their electricity from renewable sources.

"We are very excited to take this next step towards reaching our goal of being 100% renewable by 2035," said Keene Housing executive director Josh Meehan. "Thanks to our partnership with ReVision, we're reducing our operating costs while significantly reducing our real estate portfolio's carbon footprint."

The North and Gil-

sum Street project includes 302 solar panels that will generate over 113,000 kilowatt-hours of solar electricity and offset approximately 55 tons of carbon pollution each year. The Forest Views project includes 801 solar panels, and the Harper Acres project includes 300 solar panels. When the three projects are combined, Keene Housing will be producing over 470,000 kilowatt-hours of clean solar energy a year, offsetting over 250 tons of carbon pollution.

ReVision Solar Impact Partners (RSIPs) own the arrays through a Power Purchase Agreement (PPA)

Cont'd on p.17

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

### USDA RURAL DEVELOPMENT PROGRAM

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

- Finance the purchase of renewable energy systems, and make energy improvements; energy audits. Funding is awarded on a competitive basis; grant funding cannot exceed 25% of eligible project costs and combined loan guarantees and grants cannot exceed 75% of eligible project costs.
- Applicants include Feasibility studies/regular REAPs: agricultural producers and rural small businesses. Energy audits and renewable energy development assistance: local governments, tribes, land grant colleges, rural electric coops, public power entities. Grant must be used for Construction or improvements, purchase and installation of equipment, energy audits, permit fees, professional service fees, business plans, and/or feasibility studies. Find more at [www.rurdev.usda.gov/NH-VTHome.html](http://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](http://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/](http://www.grassrootsfund.org/grants/) or call 802-223-4622 for more info.

## VERMONT

### CLEAN ENERGY DEVELOPMENT FUND

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

**Advanced Wood Heating** Advanced wood pellet heating systems -- \$6,000 per pellet boiler/furnace (in partnership with Efficiency Vermont). Commercial spaces over 5,000 sq. ft. may also be eligible for incentives. See [www.rerc-vt.org](http://www.rerc-vt.org) or call (877) 888-7372.

- Retail sales of “Advanced Wood Boilers” are exempt from Vermont’s 6% sales tax. <http://tax.vt.gov/exemptions>
- Residential Bulk Pellet Bins. Up to \$3,000 rebate.
- Coal Change-out adder. Up to \$7,000 additional incentive for a pellet heating system if replacing a coal heating system. Businesses can get up to an additional \$27,000 incentive.
- Details at [www.rerc-vt.org](http://www.rerc-vt.org) or call (877) 888-7372.

• **More into at [fpr.vermont.gov/woodenergy/rebates](http://fpr.vermont.gov/woodenergy/rebates)**

#### • Windham County

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

**In Rutland & Bennington County** (and towns in neighboring counties that boarder Rutland Co.) contact Melanie Paskevich [mpaskevich@nwvvt.org](mailto:mpaskevich@nwvvt.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](http://RERC-vt.org)

#### Other Utilities Heating Offers

- Members of Washington Electric Co-op (WEC) can get a \$1000 rebate on approved pellet boilers and \$500 for pellet furnaces. This can be combined with the CEDF and Efficiency Vermont incentives for a total of \$7000; \$250 for qualifying pellet or wood stove installed by a qualified installer. This can be added to stove offers from CEDF and Efficiency Vermont.
- Members of the Vermont Electric Co-op can get a \$150 credit on the purchase of an approved pellet stove: [www.vec/energy-programs](http://www.vec/energy-programs).
- Stowe Electric Customers can get a \$150 rebate with the purchase of a pellet stove.

### VT TAX CREDITS

- Vermont offers an investment tax credit for installations of renewable energy equipment on business properties and wood and pellet heaters with at least 75% efficiency. The credit is equal to 24% of the “Vermont property portion” of the federal

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

#### Tier III programs

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

### EFFICIENCY VERMONT

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

#### Lighting

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

#### Weatherization

- Comprehensive air sealing and insulation projects with an Efficiency Excellence Network contractor: 50% off eligible project costs, up to \$1,000. Moderate income Vermonters get 50% off up to \$3,000.

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

#### Appliances (must be ENERGY STAR)

- Dehumidifiers: \$25 - \$40 rebate
- Clothes Dryers: \$200-\$400 rebate

#### Heating/Cooling/Water Heating

- Central wood pellet boilers and furnaces: \$6,000 rebate (in partnership with CEDF)
- Advanced pellet or cord wood stove: \$500 discount at participating retailers, plus \$100 for proper removal/disposal of old stove
- Heat Pumps:
  - Air-to-Water System: \$1,000/ton rebate
  - Ducted Systems: \$1000-\$2000 discount at participating distributors
  - Ductless Heating & Cooling System: \$350-\$450 discount at participating distributors
  - Heat pump water heaters: \$300-\$600 discount at participating distributors;
  - Moderate-income Vermonters are also eligible for bonus rebates up to \$500 for heat pumps and heat pump water heaters.
- Window air conditioners: \$200 for select ENERGY STAR Most Efficient models.
- Smart thermostats: up to \$100 back for select ENERGY STAR models.
- Electric utility rebates may also be available.

#### Residential New Construction

- Enroll to receive a home energy rating, expert technical assistance, and incentives – Efficiency Vermont Certified™ projects receive up to \$4,000 cash back
- Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives

#### Other Opportunities to Save

- Home Energy Loan – finance up to \$40,000 in energy-related home improvements with interest rates starting at 0%. Restrictions apply.

- Additional incentives may be available through your local electric utility provider, contact your utility for more information.

### Incentives for Pro-environment Agriculture Behaviors

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

The responses of Vermont farmers suggest that if these programs were able to provide better technical assistance, they would both likely see increased participation.

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

### Project PowerShift: For WEC Members

Help Washington Electric Co-Op keep energy costs lower for our community.

*Attention: Washington (VT) Electric Co-op (WEC) members have a limited-time opportunity to make a difference in our communities!*

WEC gets 100% of its power from renewable sources, a source of pride for our co-op members. Recent advancements in communication technology means the co-op can reduce costs by shifting energy use to get the most benefits out of renewable energy, but we need your help!

When peak demand is high it causes increased operational costs and that can impact electricity rates. Most electricity is used when we get home and settle into evening routines (dinner, laundry, TV, etc).

By shifting the times that grid-enabled water heaters and electric vehicle (EV) chargers in WEC homes use energy, technologies like water heaters and EVs can be enabled to flex their usage patterns to times when utility costs are lowest and powered by the cleanest sources. If we can shift energy use to a different time of the day, rates can be lower for everyone.

Project PowerShift is an opportunity to test a new, exciting technology that will help the co-op reduce costs and maintain our 100% renewable status.


Participating members can receive free installation of a small device that enables your water heater to act just like a battery or receive a level 2 EV charger that will charge your car at the most energy efficient times.

When a peak energy demand event is predicted, a signal is sent to your water heater or EV charger that will optimize what time of day it uses energy. These devices will help avoid using energy during the peak times.

Water heaters will preheat earlier in the day and be ready for use when needed.

Your EV charger will be able to charge your battery when operational costs are lower and the electric grid is powered by cleaner sources.

“We have over \$4 million in peak related costs. If we could shave off 10% of these bills that would be significant, and we in turn can pass along those savings to members,” states Patty Richards, WEC General Manager.

Watch the video for a helpful explanation and learn more at <https://www.efficiencyvermont.com/powershift>. 



## 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](mailto: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](http://www.puc.nh.gov/Sustainable%20Energy/RenewableEnergyRebates-CI.html).

### Residential Solar/Wind Rebate Program

-Effective January 2, 2018, this program offers rebates to qualifying NH residents who install photovoltaic (PV) or wind turbine electrical generation systems. Rebate levels are \$0.20 per watt of panel rated power up to \$1,000, or 30% of the total facility cost, whichever is less. *Check for updates at <http://www.puc.state.nh.us/Sustainable%20Energy/RenewableEnergyRebates-SREG.html>*

### Residential Solar Water Heating Rebate Program

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

### Commercial Bulk Fuel-Fed Wood C&I Pellet Central Heating Systems

- 40% of the heating appliance(s) and installation cost, up to a maximum of \$65,000. An additional 30% up to a maximum \$5,000 is available for thermal storage. Systems must be 2.5 million BTU or less

### Residential Wood Pellet Boiler/Furnace

- 40% of installed system up to \$10k
  - Must meet thermal efficiency and particulate emissions standards
- [www.puc.nh.gov](http://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](http://www.bit.ly/NHtownRenewablesTaxBreaks)

- These are offered on a town-by-town basis.
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes
- Information at [www.nh.gov/osi/energy](http://www.nh.gov/osi/energy) for more information.

### NH Electric Cooperative Incentives for Electric Vehicles and Electric Car Charging Stations

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

### NH Electric Cooperative Incentives for Electric Vehicles and Electric Car Charging Stations

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

### NHEC offers incentives for Level 2 Electric Vehicle Charging Stations.

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

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

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

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

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

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

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

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

### ENERGY STAR Heat Pump Water Heater

– (Must meet or exceed 2.3 energy factor ) \$750 rebate on 50 gallon or greater

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

### NH Home Performance with ENERGY STAR

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

- Visit [www.NHSaves.com/HPWES](http://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](http://www.NHSaves.com/newhome) for more details.

### NHSaves Residential ENERGY STAR® certified Products Program

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

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

### NHSAVES Online Store

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

### Plymouth Area Renewable Energy Initiative (PAREI): [plymouthenergy.org](http://plymouthenergy.org)

- **NH Solar Shares:** [nhsolarshares.org](http://nhsolarshares.org)

**NHSaves:** [nhsaves.com](http://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](http://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/](http://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/](http://www.NHSaves.com/) for information about NH business incentives for electric-ity efficiency.

### NH Weatherization Assistance Income-Eligible Programs

Home Energy Assistance and NH community action Weatherization Assistance Program. Financial assistance paying fuel bills, and free weatherization improvements for qualified applicants. Funding from U.S. Dept. of Energy, NH utilities.

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

### Community Development Finance Authority (CDFA) Clean Energy Fund

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

to support energy efficiency and renewable energy projects.

### Small Business Energy Audit Grants

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

### Community Facilities Energy Assessment Grants

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

Find out more at: [nhcdfa.org/energy](http://nhcdfa.org/energy).

## NH Rural Renewables

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

[www.lrcc.edu/nhrr](http://www.lrcc.edu/nhrr)

Expert • No-cost • Vendor-neutral

## NEW YORK

### RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSEERDA

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 NYSEERDA: For the latest NYSEERDA solar, ground source and air source heat pumps, EV residential and commercial incentives..

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

Visit NYSEERDA'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>.

**UP-TO-DATE INCENTIVE INFO CAN BE FOUND AT: [WWW.DSIREUSA.ORG](http://WWW.DSIREUSA.ORG)**

### Extended Federal Tax Credits for Renewable Energy

Good news for renewable energy and climate action!

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

Making local renewable energy more affordable, this bill translates directly into good jobs, less climate pollution and more resilient communities.

Among the most significant measures are extended tax credits for renewable energy.

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

- **ADVANCED WOOD HEAT:** For the first time, a 26% investment tax credit applies to the installed cost of home heating and hot water systems that utilize wood pellets, chips and cordwood at efficiencies greater than 75 percent high heat value.

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

**UP-TO-DATE INCENTIVE INFO CAN BE FOUND AT: [WWW.DSIREUSA.ORG](http://WWW.DSIREUSA.ORG)**



# What's Wrong with Natural Gas?

George Harvey

When coal is mined, processed, or transported, its dust gets into the air, which is why miners get black lung disease. Most coal makes smoke when it is burned, particulate matter that causes breathing problems for people who are exposed to it. A lot of carbon dioxide (CO<sub>2</sub>) is emitted from coal fires, relative to the energy produced. Emissions go beyond CO<sub>2</sub>, however, and include a variety of toxins. Burning it in the Midwest produced much of the mercury that poisoned the lakes and rivers of New England. Coal ash is toxic, but no really good method of disposal has been developed. So, the ash gets stored in lagoons, which occasionally spill into rivers, poisoning anything living in them.

Natural gas is much better, we have been told by the industry that sells it. And if you limit your observations to coal's problems and how natural gas compares on those issues, what they say might appear to be true. But natural gas has its own problems, and many scientists who have investigated the effects on the environment say natural gas is nearly as bad as coal. Some say it is worse.

Using natural gas at a building means that it must be piped in. Since natural gas is very flammable and pipes sometimes



A gas explosion damaged a home in North Andover, Massachusetts. Photo: Whoisjohngalt, CC-BY-SA 4.0

leak, every once in a while, some building blows up. Really. In 2018, over 40 houses in the Merrimack Valley exploded or burned in a short time, because the pressure in the gas main spiked, causing the gas to leak in many homes.

The methane (CH<sub>4</sub>) in natural gas has nearly no smell, so companies add ethyl mercaptan to it to make it smell really bad. That way, people will notice leaks in homes. Unfortunately, most of the homes that burned in the Merrimack Valley did not have anyone home at the time, so nobody noticed the problem. The up side of this was that only one person was killed.

Natural gas leaks are amazingly widespread. Boston University students drove every street of the city in a specially equipped car, and they found 3,300 leaks, most of which were quite small. When scientists did a follow-up study to check the results, they found more.

Natural gas leaks are not just a fire hazard. CH<sub>4</sub> that escapes into the environment is about 84 times as potent as CO<sub>2</sub> as a greenhouse gas over a twenty-year span.

And Boston's problem is not the worst of it. Natural gas leaks happen in the gas fields, especially where fracking has been done. The oil and gas companies sometimes say they are not losing much gas in the fields, but carefully conducted studies show the leaks are a multiple of what they admitted.

Long distance pipes leak and so do storage facilities. Since depleted oil wells and caverns left after salt was removed from salt domes are used for storage, the amounts that can be in a storage facility can be huge. The Aliso Canyon gas leak of 2015 released about 100,000 tons

of natural gas from this type of underground storage.

In addition to being a powerful greenhouse gas, the CH<sub>4</sub> in natural gas is a powerful toxin. Trees near small CH<sub>4</sub> leaks sometimes die because of them. Animals can also suffer and die, including human beings.

One of the interesting aspects of natural gas is its place in the market. Historically, huge profits have been made with drilling, extracting, and selling natural gas. Of late, that has not been true. Wall Street observers have called the oil and gas industry one of the worst investments a person can make. The Dow Jones Oil & Gas Index is off about 50% from what it was four years ago, despite help from the federal government. And that index just represents the larger companies; small companies have had far worse problems.

Some larger companies in the oil and gas sector have been looking at ways to improve their business plans. One way they have tried to do this is to move from selling fuels to making plastics from oil. But plastics are so bad for the environment that they are not likely to make more money in the future.

Another possibility is to use skills in slightly different fields. One of these is the manufacture of green hydrogen (see the article on this page). Another is for those with experience on offshore drilling to work in the offshore wind industry. Danish Oil and Natural Gas switched its focus entirely to renewable energy, especially offshore wind power. Renamed Ørsted, it recently announced that it had no fossil fuels assets left at all. And Ørsted, unlike the companies that remain in oil and gas, is making money. ☺

## Hydrogen and the Energy Transition

George Harvey

It seems "green hydrogen" has a presence in the news that grows every month. Also, news articles talk about increasingly large amounts of money being spent on it. Big corporations, utilities, and national governments are putting up many millions of dollars, in some cases billions of dollars, to get production ready for something that nobody seemed to care about only a couple of years ago.

Hydrogen is very abundant. Every molecule of water has two atoms of hydrogen bonded to one of oxygen. In fact, the word "hydrogen" means "water maker," because when it burns in air the only product is water. Among other things, hydrogen can be used as a fuel, for refining metals, or to make chemicals, such as ammonia.

There are downsides to hydrogen. Right now, it is rather expensive. Storage can be a problem. It is not really possible to compress it to a liquid at room temperature, though you can liquefy it, if you cool it to 20.27°K (−252.88°C, −423.18°F). It is not difficult to compress it and use it as a gas to fuel vehicles, but that would take a big tank because a volume of compressed hydrogen might have only one quarter of the energy of the same volume of gasoline.

Today, 95% of the hydrogen that is available commercially is "gray hydrogen." Manufacturing gray hydrogen uses a fair amount of energy, which is needed to strip the hydrogen atoms out of methane. The carbon in the methane typically re-



The Danish energy firm, Ørsted, develops plans to harness offshore wind energy to produce "green" hydrogen. Image: Ørsted.

acts with oxygen to make carbon dioxide (CO<sub>2</sub>), the greenhouse gas.

Green hydrogen, by contrast, creates the gas directly from water through electrolysis, and though this uses even more electricity than gray hydrogen, the electricity in the process is carbon-free. There are no CO<sub>2</sub> emissions directly associated with green hydrogen, just hydrogen and oxygen, and the oxygen can be released without long-term danger.

Hydrogen can be made to reduce curtailment of renewable generators, such as wind turbines. Times come when the wind is blowing, but the electric grid already has as much electricity as it needs

to supply demand. A wind farm can't just dump electricity onto a grid without demand, so the grid operator can order it to curtail the turbines. The wind may be blowing, but the turbines are not allowed to make electricity. A plant that can use electricity from wind turbines to power electrolysis can make electricity to fuel the electrolysis process instead of being curtailed. That means the cost of the electricity, which is the greatest part of the cost of green hydrogen, can be brought very low.

Hydrogen can be used as a fuel. It actually can be put through an internal combustion engine that has been adapted for

the purpose, but the efficiency would be low, because internal combustion engines are by their nature inefficient. On the other hand, hydrogen can be used to create electricity in fuel cells, and that process is far more efficient, in terms of the work you get from a given amount of fuel.

We will probably never drive cars with liquid hydrogen in them because of the storage problem. Ships might be fueled by the liquid, or maybe even trains, but not road vehicles. On the other hand, hydrogen is so light that large containers of the pressurized gas could be carried in aircraft, and some studies show it would deliver more work per weight than batteries.

Another way to use hydrogen in fuel cells is to use it to make another chemical that can easily be stored and used with a fuel cell. Ammonia is one example. It is far heavier than hydrogen, but it can be liquefied fairly easily, and a fuel tank could contain enough ammonia to move a vehicle pretty far, compared to one the same size containing hydrogen.

The cost of green hydrogen is falling at a rate of about 10% per year, as the electrolysis technology improves and the cost of renewable energy from the sun and wind falls. This puts it on track to take up the electric load at times when demand outstrips supply. Green hydrogen can then be used to balance the grid just as batteries do. As costs fall, green hydrogen will put increasing pressure on the use of oil and gas, reducing the emissions of fossil fuels. ☺



# CRYOGENIC ENERGY STORAGE: A VIABLE SOLUTION?

George Harvey

The word “cryogenic” may sound like something that belongs only in science fiction, but it is really just a scientific term relating to making things very cold. In the case of energy storage, it refers to energy storage by use of very cold air, so cold it has condensed into a liquid.

When air is chilled to 79°K (-195°C, -318°F) it liquefies. When it is heated up again, it boils, just as water does when it gets hot. And the air it produces can be used to drive an engine, just as steam from boiling water can drive a steam engine.

Cryogenic energy storage is a little different from steam engines, however. It does not need fossil fuels for heat, because just about everything on Earth is hot enough to boil it. And so there are no pollutants or climate emissions from its use. The only real catch is where to get the electricity needed to run the very powerful refrigerators needed to make air condense.

There are interesting advantages to storing energy in liquid air. One of the most obvious is that the storage system requires nothing special in the way of exotic chemicals. Where lithium-ion batteries may require lithium and cobalt, and flow batteries might use large amounts of vanadium, cryogenic energy storage is based on just air.

We live in interesting times. A new energy paradigm based on renewable



Highview Power cryogenic storage plant. Photo courtesy of Mercom Capital.

energy is emerging as a challenge to the old vision of base-load, coal-burning power plants belching soot and augmented by whatever high-cost electricity will cover demands above the base load.

In the new paradigm, we need to deal with the variable nature of energy generated by the sun, wind, and water. The problem is not that the sun is not always shining and the wind is not always blowing. We can overcome those issues by overbuilding renewables. The real problem is what to do when there is too much electricity.

Historically, renewable energy production was curtailed when production was too high. An alternate solution, which is growing rapidly, is to use that excess production for something. And a great way to use it is to use it for energy storage. And that is where we can get the electricity to drive the huge refrigerators to liquefy air.

Right now, a large facility to do just that is being developed in the U.K. Highview Power, a company based in London, has been developing cryogenic systems. After building two pilot plants in the U.K., it has entered into a joint venture to build a

facility outside the city of Manchester. It says the CRYOBattery™ will be able to deliver 50 megawatts of electric power and will store 250 megawatt-hours (MWh) of electric energy. This will make it one of Europe's largest battery storage systems.

The project has been well received. The U.K. Department for Business Energy & Industry Strategy has awarded it a grant of £10 million. Also, Sumitomo Heavy Industries has invested £35 million in Highview Power, which it will use for this project.

Construction of the CRYOBattery™ project near Manchester is to begin later this year, and the facility is expected to be in commercial operation in 2022. Highview Power and Carlton Power plan to co-develop as many as four additional systems, with total energy storage coming to over 1,000 MWh.

In a recent press release, Highview Power noted, “At giga-scale, CRYO-Batteries paired with renewables are equivalent in performance to – and could replace – thermal and nuclear baseload power in addition to supporting electricity transmission and distribution systems while providing additional security of supply.”

Baseload power, from coal, gas, and nuclear sources, is not needed for this new paradigm. Pollution can be cut to practically nothing. Greenhouse gas emissions are cut to practically nothing. And this is happening at just a time when offshore wind power is competing with natural gas in the U.K. And onshore wind power and solar power are even less expensive. ☺

## RENEWABLE ENERGY LOCAL TAX WOES IN NH

G.E.T. staff

We are living in a crisis of climate change. Average temperatures are rising as we are experiencing this winter. The data is available and is addressed on the front page of this issue of Green Energy Times. It is important that we are all encouraged to act now on reducing our carbon footprint. The Federal government understands this urgency as we reenter the Paris Agreement and extensions are made to tax credits on renewable energy systems with the addition of biomass heating to this group. What some of us are not seeing is the same urgency on the local level.

Green Energy Times was contacted from a resident in Lempster, NH regarding a new real estate tax evaluation on his solar panels. He estimated the increase to be so high that it would be more economical to remove the panels. This is the completely opposite direction from the one we need to move in. Our local governments need to encourage



Ground-mounted solar arrays installed by Lempster's concerned citizen, Eckhard Straeter. Courtesy photo.

renewable energy projects and offer tax credits or abatements. Perhaps things have improved in Lempster by the time of this writing.

With a little research and effort, you can educate your local

government on the benefits of renewable energy systems and the reasons they should be exempted from taxes. A petition warrant article can be submitted for the annual town meeting. There is information on how to do this on this page of the New Hampshire Office of Strategic Initiatives' website at <http://bit.ly/NHEnergySavingIncentives>. If your city or town does not currently offer such exemptions, see the procedures for adopting local property tax exemptions (<http://bit.ly/NHAdpotPropertyTaxExemptions>) and the sample warrant article (<http://bit.ly/NHSampleWarrantArticle>) for adopting the renewable energy property tax exemptions. Local officials may be unaware of exemptions, as some have been adopted as long as thirty years ago. ☺



Overhead view of Lempster, NH wind farm. Photo: Mike Mooiman.

## Keene Housing

Cont'd from p.13

with Keene Housing. Under the terms of the agreement, the nonprofit initially agrees to purchase electricity at a negotiated rate below grid cost. After six years, KH will have the option to purchase the systems at a significant discount, enabling the housing authority to generate free solar power for decades to come. The PPA gives KH the ability to leverage the economic and environmental benefits of solar power while affording the impact partners an opportunity to make community investments that express their commitment to environmental sustainability. 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 nonprofit entering into the agreement receives a reduced electric bill plus the environmental benefits of generating clean electricity. The three arrays are expected to save KH almost \$3 million in electricity costs over the lifetime of the systems. Learn more at [ReVisionEnergy.com](http://ReVisionEnergy.com).

Keene Housing provides access to safe, affordable housing for close to 1,000 households throughout New Hampshire's Monadnock Region. This is, in part, due to their participation in the U.S. Department of Housing and Urban Development's Moving to Work Demonstration (MTW). Learn more at [keenehousing.org](http://keenehousing.org). ☺

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# What is Geothermal Energy?

## How CAN I HEAT AND COOL MY HOUSE WITH IT?

Joe Parsons

If you've heard about geothermal energy, you may be thinking it's exclusive to places that expose elements of the earth's interior like a hot spring or geyser. But the fact is, no matter where you find yourself on land on the planet, there will always be near fifty-degree Fahrenheit temperature, both winter and summer just below your feet.

That's where geothermal heating and cooling systems play a vital role in renewable energy, tapping into the constant temperature of the ground. According to [epa.gov](http://epa.gov), "Geothermal technology harnesses the earth's heat. Just a few feet below the surface, the earth maintains a near-constant temperature, in contrast to the summer and winter extremes of the ambient air above ground."

In many instances, using a looped pipe, geothermal systems can mobilize the temperature of the earth to circulate both heating and cooling into any home. It's incredibly efficient and requires far less use of fossil fuels than conventional heating and cooling systems. When looking for renewable ways to heat and cool a home, it's hard



Ground absorption schematic. Image: ClimateMaster, Inc.

to beat geothermal heat pumps (GHPs).

How Do Geothermal Heat Pumps Work?

The technical side of geothermal energy and how to harness it may seem complicated, but it's not all that unfamiliar. We have appliances in our homes that already use some of the fundamental technology it takes to run these units. For example, the basic refrigeration cycle that we see in every window air conditioner, every refrigerator, even to cool our cars, can utilize water to make our atmosphere comfortable.

Where a heat pump is incorporated in a typical forced air application, air is blown across the coils of hot gas heating the house, the refrigerant is then cooled by

the air, and it turns back into a liquid, and the process repeats. The same equipment can be used to cool the house in the summer simply by pumping the refrigerant in the opposite direction.

The difference with how a geothermal heating and cooling system works is simply by having interaction with the ground and its constant temperature. ClimateMaster, experts in geothermal technology, describe it as moving or "pumping" heat out of the ground or into the ground in order to make a house comfortable.

Because the key component for any GHP is to be in contact with the ground, it needs a point of connection to the earth. Geothermal bores can be installed

vertically or horizontally to accommodate the available land area. Loops are inserted into the boreholes and backfilled with thermal grout to ensure proper contact with the earth resulting in optimal heat transfer.

National Geographic explains, "The pipes that make up an earth loop are usually made of polyethylene and can be buried under the ground horizontally or vertically, depending on the characteristics of the site. If an aquifer is available, engineers may prefer to design an 'open loop' system, in which a well is drilled into the underground water. Water is pumped up, run past a heat exchanger, and then the water is returned to the same aquifer, through 'rejection.'"

With a geothermal system, this cycle repeats until your home reaches a desired temperature. The advantages of literally pumping heat out of the house or into the house from the earth itself are not only that it's eco-friendly, but it pays off in lower costs for heating and cooling alike.

**Are geothermal heat pumps right for you?**

Many homeowners and businesses have made energy efficiency and reducing their carbon footprint high



Cont'd on p.19 >>

## See Why New York Homeowners are Making the Switch to Geothermal

### Quiet

Geothermal systems use a ground loop to expel heat from your home so there is no noisy outdoor condensing unit like a traditional air-to-air heat pump. ClimateMaster geothermal heat pumps can be placed in a basement, garage, closet or utility room. This helps reduce noise, improves the look of your home and leads to longer system life.

### Efficient

ClimateMaster's Trilogy® packaged systems are some of the most efficient geothermal HVAC systems in the residential market.

### Sustainability

Geothermal technology uses a series of sealed piping loops buried in the ground that tap the renewable and sustainable energy of the earth for both cooling and heating.

### Trilogy® packaged systems feature:

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- Heating up to **5.1 COP**
- Infinitely variable-speed **compressor, blower, and loop pump**
- Provides 100% of your domestic hot water!

### Want to learn more?

Throughout 2021 ClimateMaster is sponsoring a series of monthly podcasts and web classes to provide you the information you need to understand the benefits of geothermal in your home.

Visit <https://geothermal.climatemaster.com/go/green> for more info.

### Federal Tax Credit

26% of total installed cost - no cap.

### NYS Clean Heat Incentives

Electric utility companies offer rebates on both air and ground source heat pumps. Visit your electric company's website or reach out to them to learn more.





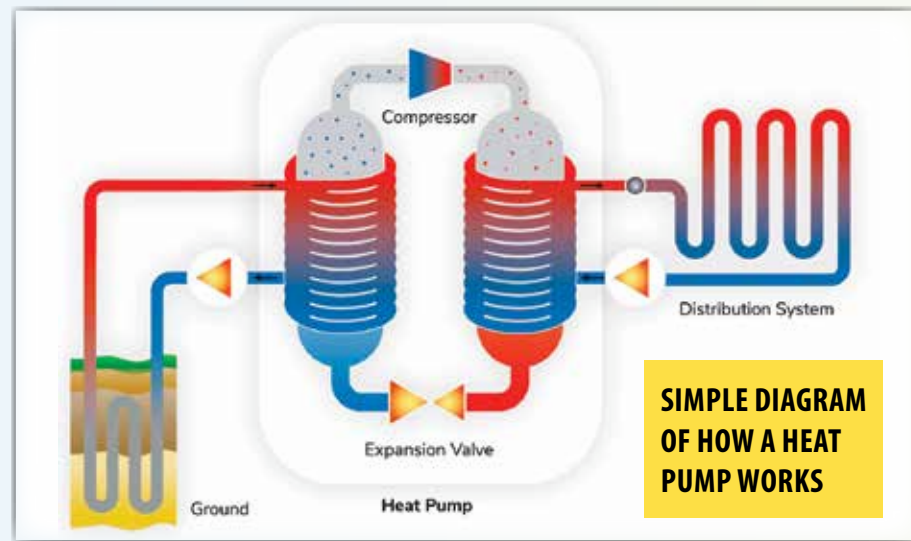
<< Cont'd from p.18

on their list of priorities. Renewable energy is certainly what GHPs can help deliver. If you're a homeowner weighing the effects of modern life's impacts on the ecosystem, geothermal is more than worth considering. Its advantages aren't one-sided either.

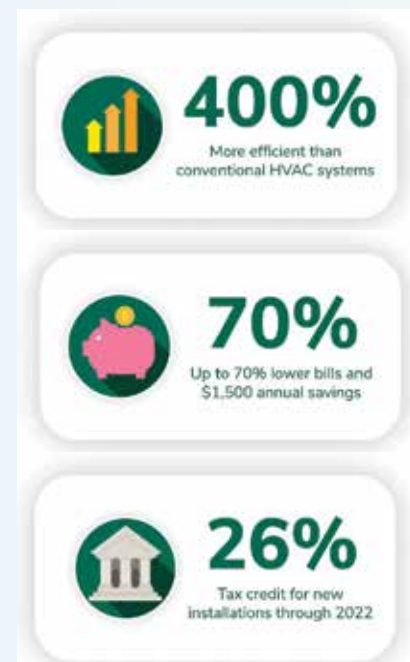
On average, geothermal systems are 400% more efficient, compared to traditional gas or oil furnaces which max out about 75 to 98% of efficiency. The heating performance of a geothermal system is based on its coefficient of performance (COP). For every unit of energy consumed by the GHP, an average of four units of energy in the form of heat are delivered to the conditioned space. Conversely, a fossil fuel furnace efficiency is measured by its annual fuel utilization efficiency (AFUE). For each unit of fuel consumed by the furnace, only 75 to 98% of the energy

And perhaps the most convenient benefit is that geothermal systems are generally eligible for rebates and require less maintenance than conventional units. Since the major components of a geothermal heating and cooling system are buried, taking advantage of the temperature that is simply in the ground, they often have warranties of up to fifty years. And inside the home, the GHP unit has a lifecycle at an average of twenty-five years, making them one of the most long-lasting systems on the market.

If you have an existing house with high energy bills, it most likely means you currently use propane, oil, or electricity for heating and cooling. And if you're a homeowner preparing for a new build, with a geothermal system, you could be saving on heating and cooling costs from day one. So regardless of which applies to you, a geothermal solution could be exactly what you're looking for.



is returned in the form of heat to the conditioned space. The remaining byproducts of combustion are released into the atmosphere. Overall, around 70% of the energy used by GHPs comes from renewable sources. According to comfort-pro.com, the energy savings from geothermal cooling systems is hands-down the number one reason to consider this type of technology. A GHP reduces energy costs by 30-70% on average which is why homeowners can typically recoup investments of a geothermal installation through energy savings in five to seven years. According to the U.S. Environmental Protection Agency, geothermal heating and cooling systems have the lowest cost over their lifetime compared to traditional systems.



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Joe Parsons has worked in the renewables and environment industry for over 40 years. Joe is the Residential Product Manager for ClimateMaster, Inc. He is a founding member of NY-GEO and is the treasurer of the California Geothermal Heat Pump Association. ♻️

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## A Future For The Planet

COURTESY OF THE U.S.A.

– Cont'd from p1

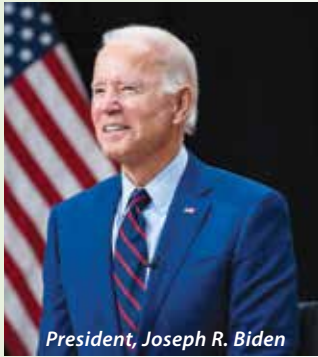
Biden did not mince words. He said this:

Today is "Climate Day" at the White House and – which means that today is "Jobs Day" at the White House. We're talking about American innovation, American products, American labor. And we're talking about the health of our families and cleaner water, cleaner air, and cleaner communities. We're talking about national security and America leading the world in a clean energy future.

It's a future of enormous hope and opportunity. It's about coming to the moment to deal with this maximum threat that's now facing us – climate change – with a greater sense of urgency. In my view, we've already waited too long to deal with this climate crisis, and we can't wait any longer. We see it with our own eyes, we feel it, we know it in our bones, and it's time to act.

The president understands that climate change is a serious problem that needs to be addressed. It is an issue that has negative effects on all Americans and will only get worse unless we address it. And climate change is an issue that creates its own set of needs. One of these is jobs, and the president makes it clear right from the start that dealing with climate change means we will be creating jobs paying good wages for people in all parts of America.

President Biden also speaks of tackling climate change as a matter of national security, and states that this is not an exaggeration. He notes that two thirds of our military bases are threat-



President, Joseph R. Biden

ened in at least some way because of the climate crisis. We have been watching for years as legislators in Congress have heard pleas from military leaders who testified that the crisis is growing, only to do nothing about it. Now we have a president who is getting active about addressing the problems the Pentagon has brought up.

Our response to the climate crisis is critically important. The president called the crisis "existential." This word is used in exaggerations sometimes, but in this case, it means exactly what it says: We have a crisis that can have a bearing on our very existence, as a society, and possibly as a species.

The president's plan of actions to tackle these existential crises covers the following:

- End fossil fuel subsidies,
- Create a task force to plan how to reduce greenhouse gas emissions,
- Identify climate change as a national security issue,
- Protect 30% of federal land and water by 2030,
- Create a Civilian Climate Corps,
- Address the needs of people living in communities with special pollution problems,
- Create a White House interagency council on environmental justice, and
- Direct agencies to do science-based decision making.

Addressing climate change will require a lot of work. He said, "[D]ealing with this existential threat to the planet and increasing our economic growth and prosperity are one in the same. When I think of climate change, I think of ... jobs." And they are not just jobs putting up wind turbines or solar panels. They include a huge variety

of jobs for nearly every aspect of American life.

There are many areas to note. One is agriculture. The president said he wants to see America be the first country in the world whose agriculture has net-zero greenhouse gas emissions. He also wants to see 500,000 electric vehicle charging stations installed in this country. His orders will have all vehicles of the federal government be electric by 2025.

He wants all electricity generation in this country to be free of carbon pollution by 2035. He points out that 84% of new generating capacity expected to be added this year will be clean, and it is cheaper.

He spoke of new housing being energy-efficient. And he spoke of the financial benefits that efficiency will have for many people, especially those who are from disadvantaged areas and groups. He spoke specifically about the benefits of weatherization which will reduce the cost living for many people.

The change will be driven in part by jobs and education. We need expert iron workers and welders. We need technicians and scientists. We need to build structures, and we need the products of our laboratories.

At the center of all of this is the concept of environmental and economic justice. Many people need these things because of such things as race and lack of access to quality education; others suffer from health problems caused by air pollution or unsafe water. Also, there are people in communities that have been long disadvantaged



Vice President, Kamala Harris

because of dependence on already dying technologies, including oil, gas, and coal. There is a lot of work to be done, much of it local to these people, which will create more local jobs. President Biden mentioned capping a million oil wells, reclaiming mines, and building economic hubs on brownfield sites. He said, "We're never going to forget the men and women who dug the coal and built the nation. We're going to do right by them."

The executive actions President Biden signed are not just words. They are not a wish list of things we can think about. They direct specific actions. And they will be guided by a team of people who are experts in their fields.

In particular, we could mention Former Secretary of State John Kerry, who will be Special Presidential Envoy for Climate, and the former EPA Administrator Gina McCarthy, who will be the National Climate Advisor. Of special note, however, is Vice President, Kamala Harris, who ran for president in the primaries as a strong environmental candidate.

We at *Green Energy Times* say this is an amazing way to start a presidential term. It is a plan that addresses every topic we write about. And it is an outstanding plan to tackle the existential climate crisis that faces us. It is already too late to delay any longer. ♻️



John Kerry



Gina McCarthy

# CUTTING EMISSIONS TO ZERO COULD SAVE THE PLANET

George Harvey

Many readers will recognize the work of climatologist Michael E. Mann. He is the person who introduced us to the "Hockey stick graph" showing the rapid rise in global temperatures that has happened in the past fifty years. Now, he has brought us new information, which could be important. Fortunately, it sets a somewhat optimistic tone, though it came with some important warning notes.

Mann's warnings could be summed up by saying we need to act on the climate quickly. Writing before our general election, he wrote that another four years with Donald Trump as president would put the action off too long. That issue, fortunately, is behind us. But even with a new administration, waiting for any length of time is a luxury we cannot afford.

Having given that warning, we can sum up the more optimistic view. CBS recently conducted an interview with guests including Michael Mann and James Hansen on climate change (<http://bit.ly/CBS-Mann-interview>). Mann said he believed global warming can be stopped. He said that oceans and forests could begin to absorb the excess carbon dioxide (CO<sub>2</sub>) within years, if emission are reduced to close to zero.

To understand the problem and what it means, we should look at the CO<sub>2</sub> burden in the atmosphere. CO<sub>2</sub> traps



Peat bog, a champion for drawing down carbon. Michal Klajban, CC-BY-SA 4.0, [www.bit.ly/38OKcvq](http://www.bit.ly/38OKcvq).

heat from the sun. As the amount of CO<sub>2</sub> has been increased by burning fossil fuels, the heat being trapped has also increased. It takes a long time to heat a planet, so the CO<sub>2</sub> we have will continue to heat the Earth until the amount is greatly reduced. The CO<sub>2</sub> is normally drawn down by rain and growing plants, but conventional wisdom is that it could take centuries for that to happen, while the Earth continues to heat up. Mann believes, however, that if we reduce emissions quickly enough, we can still prevent the worst-case scenario from developing, because scientists may have underestimated the ability of nature to recover.

The unfortunate part of this is that the emissions must be reduced dramatically

and very soon.

Other statements by Mann warn us plainly about what happens if we fail to do so.

One very big threat we have is the fact that polar ice is melting. The record we can put together of polar ice at different times in the past shows that the ice is melting at a rate unlike anything that has happened naturally. Accord-

ing to James Hansen, if the melting gets too far, with ice sheets disintegrating, it would become impossible to stop their decline at all. The rise would make our coastal cities uninhabitable, and over half of the world's cities are coastal. The current situation is that the ice sheets are disintegrating already.

On the continuing disputes over science of climate change, one thing Mann said was, "There's about as much scientific consensus about human-caused climate change as there is about gravity." That means that disagreement among scientists about whether human-caused climate change is happening, is about the same as a disagreement among scientists over whether gravity exists.

Nevertheless, there is disagreement about climate change, but the real disagreement seems to be about what can be done. Some scientists say we can stop climate change fairly quickly, so things will continue to get worse for only a couple of decades. Other scientists seem less hopeful and foresee a time in which huge numbers of people will have to move away from the coasts and live on higher ground.

Regardless of whether we expect that things will only get somewhat worse than they have been of late or move into a dystopian future, it is safe to say that just about all scientists in the field agree on one other thing. To mitigate the damage of climate change, we have to act very quickly.

There is one more aspect to this that not many people are talking about. We do not know what science will develop over the next thirty years, and we do not know how the technology we currently have will be applied. This is not a matter of technology and big business. It is a matter of understanding the needs of the land and the living things on it. Though we do not know how it will happen, we can be sure that our understanding of such things will develop. That may be another reason to hope.

We will have more about Michael Mann in the next issue of *Green Energy Times*, which will have a review of his latest book. It is titled *The New Climate War*. ♻️



# NEW YORK STATE HAS BIG PLANS FOR CLEAN, GREEN ENERGY

Brett Yates

In January, New York Governor Andrew Cuomo made renewable energy a focus of his annual State of the State address in which he pledged an aggressive government agenda to rebuild the nation's third-largest economy for the post-coronavirus era. According to Cuomo, the state's Green Economic Recovery Program, proposes to use \$29 billion in public and private investment to create 50,000 jobs and 12,400 megawatts of clean electricity (enough to power six million of New York's 7.5 million homes). The program will play a central role in the economic recovery.

Calling green energy "a new economic engine which is future-oriented, is essential to our survival, and that has the potential to benefit generations to come," the governor promised a "true transformation" for New York's energy system. "Piecemeal, episodic, or incidental efforts will fail," he warned.

In 2021, Cuomo announced public-private partnerships that will spur the development of 23 new solar farms and one hydroelectric plant, which will join 68 large-scale clean generation facilities contracted by the state over the last five years, as well as a 20-megawatt battery storage facility now under construction by the New York Power Authority (NYPA) in Chateaugay. The New York State Energy Research and Development Authority (NYSERDA) solicits new projects from the private sector by offering procurement contracts for renewable energy credits (RECs) to bidders who, in turn, submit proposals in accordance with NYSERDA criteria to construct carbon-free generation facilities to produce them. NYSERDA eventually resells the RECs to regulated utilities like Con Edison, which purchase them under state mandate.

The latest and biggest winner in this process is the Norwegian state-owned enterprise Equinor, which secured a significant offshore wind contract in 2019. They responded in 2020 to NYSERDA's request for proposals with a plan for an additional 2.5 gigawatts of capacity on two sites in federal waters near Long Island. The subsequent agreement, revealed during Cuomo's address, represents "the largest procurement of renewable energy by a state in U.S. history." turbines. The British oil giant, British Petroleum (BP) will own a 50% stake in the pair of wind farms, which together will feature



Governor Andrew Cuomo delivers the 2021 State of the State address. Photo: Darren McGee, Office of Governor Andrew M. Cuomo.

more than 180 turbines.

To facilitate the manufacturing of these turbines, as well as their staging, operations, and maintenance, New York State will reconfigure and modernize five of its ports. These are the Port of Coeymans, Port Jefferson, the Port of Montauk Harbor, and with the help of Equinor, the Port of Albany and the South Brooklyn Marine Terminal. Private investment will cover 75% of the \$644 billion cost, producing a unique wind-focused arsenal of maritime infrastructure lining the Hudson River, Long Island Sound, and New York Harbor, as well as 2,600 jobs.

Cuomo hopes to fill these positions with graduates from the new Offshore Wind Training Institute at SUNY Stony Brook and Farmingdale State College, which he expects to open this summer. An additional program, the Climate Justice Corps, will fund 150 yearlong fellowships in the green energy industry for "residents of disadvantaged communities."

The fourth pillar of New York's clean energy agenda – alongside generation, manufacturing, and job training – is transmission. Two-hundred and fifty miles of a "green energy superhighway" will begin construction this year to bring clean upstate power to downstate consumers. Due to a congested grid, they currently rely on New York City's dirty, gas-fired "peaker plants" on high-demand, hot summer days.



Statue of Liberty: Markus Gjengaa

This year will also mark the groundbreaking of the long-planned Champlain Hudson Power Express, a high-voltage link between Quebec and Queens. This is proceeding despite criticism from environmental groups and industry competitors. They charge that rerouting Canada's existing hydropower to a new export market will undercut home-grown renewables without reducing global emissions.

A host of smaller state-led initiatives – such as low-interest loans for energy efficiency retrofits within the Division of Housing and Community Renewal's portfolio of affordable housing. The installation of 2,500 fast chargers for electric vehicles over the next two years, and the provision of NYPA advisory services to municipalities looking to develop community solar – round out New York's green energy program. But its public transportation agenda – which includes eight extra tracks at Penn Station, a Second Avenue Subway extension, two additional railway tunnels beneath the Hudson, a revamped Port Authority Bus Terminal, and in the more immediate term, 100 electric buses for the MTA and other transit agencies – will also play an important role in reducing the state's carbon emissions.

Transportation investments account for \$190 billion of the \$306 billion multiyear infrastructure plan touted in Cuomo's executive budget, released a week after his State of the State address. The plan – whose eye-popping total incorporates a \$100 billion suite of projects initiated in 2016, another infrastructural injection of \$150 billion in 2018, the implementation of the MTA's four-year capital plan in 2020, and \$31 billion of new public works – requires a \$17.6 billion capital disbursement in Fiscal Year 2022, which begins in April.

In 2019, New York State won praise from environmental activists when its legislature approved the Climate Leadership and Community Protection Act, mandating 70% renewable

**\$29 BILLION  
IN PUBLIC  
AND PRIVATE  
INVESTMENT TO  
CREATE 50,000  
JOBS AND 12,400  
MEGAWATTS OF  
CLEAN ELECTRICITY  
(ENOUGH TO POWER  
SIX MILLION OF  
NEW YORK'S 7.5  
MILLION HOMES).**

power by 2030 and a zero-carbon electricity sector by 2040. For many of the same advocates, Cuomo's unprecedented bet on offshore wind and the establishment of other green energy programs highlighted in his State of the State address have signaled a commitment to upholding these goals.

"As New York looks to rebuild, nothing holds more potential to get our economy humming again than clean energy. The governor's roadmap for the year ahead reflects this understanding – and demonstrates a commitment to powering our future with cleaner, healthier and more equitable solutions," Rich Schrader, the New York Legislative Director for the Natural Resources Defense Council, enthused.

Cuomo, a Democrat, has served since 2011 as the governor of New York, and he plans to run for a third re-election in 2022.

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



Moynihan-Trail-Hall-Courtesy-of-Gov-Andrew-Cuomo-via-Flickr

## INVESTMENTS IN A CLEAN ENERGY ECONOMY BENEFIT ALL VERMONTERS

From Renewable Energy Vermont

In his annual budget address on January 26, Vermont Governor Phil Scott proposed a range of clean energy investments to lower energy burdens and climate pollution while supporting Vermont's economy. The Governor's climate economy proposals include \$10 million toward an initiative to bring local, renewable energy to those with low and moderate incomes, \$5 million to accelerate Vermont's transition to electric and more fuel-efficient vehicles, and \$20 million for weatherization and energy efficiency.

In the following statement, Olivia Campbell Andersen, Renewable Energy Vermont's Executive Director expressed support, citing the benefits these proposals offer to all Vermonters.

"Every Vermonter, particularly those with the highest energy burdens, must be able to equitably access local solar, electric vehicles, and efficient homes. The Governor's proposed support for expanding energy efficiency and climate resilience with local renewable energy will save Vermonters money on their energy bills, make their homes more comfortable and reduce climate pollution.

"State energy investments should leverage both private capital and federal funds to lower energy burdens and help grow existing and new businesses to maximize the number of Vermonters served. More than 18,900 hardworking Vermonters are employed in renewable energy, clean transportation, and efficiency jobs, representing 6.1% of Vermont's workforce. Targeted investments in these sectors will provide immediate economic benefits to communities rebuilding from the devastation of Covid-19.

"The Governor's proposal will also help more Vermonters access electric vehicles (EV), saving millions of dollars in transportation costs. For every \$1 invested in EV incentives, Vermonters save more than \$3 on gas, car maintenance, and health bills.

"We look forward to working with the Governor and legislators to advance necessary climate budget and policy proposals that expand Vermonters' ability to make choices about their energy." ♻️



Offshore wind. Image: Nicholas Doherty



# STAY WARM WITH LOCAL, RENEWABLE HEATING

NEW INCENTIVES FOR ADVANCED WOOD HEAT HELP CUT COSTS, CLIMATE POLLUTION, AND BOLSTER LOCAL ECONOMY

Renewable Energy Vermont (REV) applauded U.S. Senators Patrick Leahy and Bernie Sanders and Congressman Peter Welch for supporting smart investments in renewable energy that can grow our local economy while addressing the climate crisis.

Thanks to their efforts, a federal tax credit is now available to cover 26% of the installed price of new residential advanced wood heat systems, making it easier for Vermonters to stay warm this winter. "This is a real step forward in helping everyday Vermonters save money on their heating bills," said David Frank of SunWood Biomass in Waitsfield. "It helps Vermont get closer to meeting its renewable energy goals, while supporting our local forest health and economy."

A recent study (<http://bit.ly/VT-forestwood-study>) prepared for the Vermont Department of Forests, showed that Vermont has 940,000 tons of additional wood capacity that could



be used sustainably every year. If this were used locally for high-efficiency heating and hot water systems, it could replace the equivalent of 66 million gallons of heating oil annually, reducing CO2 emissions by 792,000 tons per year. Utilizing renewable resources within our borders, we can forgo sending \$131 million out of state every year on heating oil and instead

invest \$70 million annually back into our local economy. Seventy-eight cents of every dollar spent on fossil fuel heating goes out of the state, while using local wood, much like local food, keeps our energy dollars local.

"Many Vermonters rely on their wood stoves to stay warm through our long winters," said Congressman Peter Welch. "Reducing the cost for cleaner and more sustainable heating systems is just common sense, and a win-win for the environment and homeowners. Thank you to Renewable Energy Vermont for all they do to support local renewable energy and helping to keep our neighbors warm."

Wood fuels sourced locally from well-

managed forests and used to replace fossil fuels in high-efficiency advanced wood heat and hot water systems further the state's carbon emission reduction commitments. The Intergovernmental Panel on Climate Change (IPCC), the leading international body for the assessment of climate change, found that "In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fiber, or energy from the forest, will generate the largest sustained [carbon emission] mitigation benefit." (Source: <http://bit.ly/VT-carbon-emissions-woodheat>)

"Advanced wood heat helps maintain Vermont's working lands, reliably meet Vermont's heating needs, reduce pollution, lower heating costs, and create well-paid trade jobs," said Olivia Campbell Andersen, Renewable Energy Vermont's executive director. "Combined with up to \$7,000 in state rebates from Efficiency Vermont and local utilities, and no sales tax, the new 26% federal tax credit for advanced wood heating systems takes the chill out of winter."

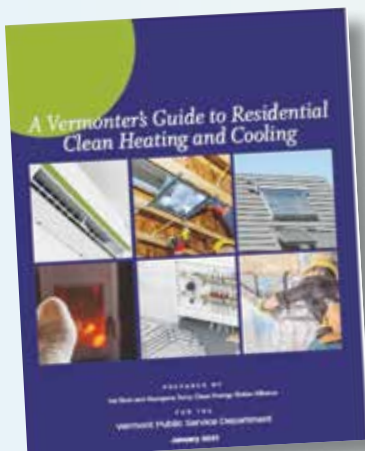
The new federal tax credit applies to the installed cost of home heating and hot water systems that use wood pellets, chips and cordwood at efficiencies greater than 75% high heat value. A federal income tax credit of 26 percent commences with systems purchased in 2021 and phases down to 22% in 2022 and 2023. A wood pellet stove that costs \$4,000 to install in 2021 will realize a savings of \$1,040 once the credit is applied to a homeowner's 2021 tax return.

Advanced wood heat is a widely recognized, energy-efficient way to heat homes and businesses with all of the convenience of a traditional heating system, thanks to the automated system which feeds the pelleted or chipped wood fuel into the system. Advanced wood heating systems combine the convenience of a thermostat-controlled gas or oil system, with the savings of wood fuel, which has less-volatile prices than fossil fuels and is locally sourced.

## Residential Clean Heating and Cooling

### A new guide for Vermonters and the region

Clean Energy States Alliance



Nearly 80% of Vermonters heat their homes by burning fossil fuels which contribute significantly to climate change, are a drain to the local economy, and can worsen air quality. The remaining households are heated by burning wood or with various electric heating technologies. To meet their own and the state's renewable thermal objectives, many Vermont homeowners are looking to transition from fossil fuels to clean heating and cooling (CH&C) technologies.

This guide provides information and guidance on how to make that transition.

Supporting the transition to cleaner heating and renewable energy is in line with Vermont's Comprehensive Energy Plan, which calls for Vermont to increase the portion of renewable energy used to heat Vermont's building sector to 30% by 2025. This goal builds on the state statutory goal to weatherize 80,000 homes and reduce fuel use and utility bills by 25%.

The Clean Energy States Alliance (CESA) has published A Vermonter's Guide to Residential Clean Heating and Cooling to inform Vermont residents about the benefits of CH&C technologies. The guide, prepared for the Vermont Public Service Department's Clean Energy Development Fund (CEDF), provides information on CH&C technologies to help Vermonters make informed decisions regarding heating and cooling their homes.

This extensive 60-page guide provides in-depth coverage of CH&C technologies. It is broken into ten sections:

1. Efficiency First.
2. Why Should I Install a CH&C System in my Home?
3. What are CH&C Technologies?
4. Are CH&C Systems Right for my Home?
5. Assessing Your Home's Current Distribution System for Heating.
6. Assessing Your Home's Current Home Heating and Hot Water Systems.
7. Cooling Your Home.
8. Integrated Smart Thermostats and Controls.
9. Selecting a Contractor/Installer and System Maintenance.
10. Incentives and Financing.

The guide is available online at <http://bit.ly/CESA-VT-home-heat-guide>.

Learn more about CESA at [www.cesa.org](http://www.cesa.org). Contact: Samantha Donalds, [Sam@cleanegroup.org](mailto:Sam@cleanegroup.org) or 802-223-2554 x204.

Learn more about the Vermont Public Service Department and the Clean Energy Development Fund (CEDF) at <http://publicservice.vermont.gov/renewable-energy/cedf>. The CEDF contact is Andrew Perchlik at [Andrew.Perchlik@Vermont.gov](mailto:Andrew.Perchlik@Vermont.gov) or 802-279-0471.

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More information about renewable heating, incentives, and installers can be found at [www.revermont.org/go-renewable/heating-cooling/](http://www.revermont.org/go-renewable/heating-cooling/).

Renewable Energy Vermont (REV) represents businesses, non-profits, utilities, and individuals committed to eliminating our reliance on fossil fuels by increasing clean renewable energy and energy efficiency. VT's clean energy economy supports at least 18,800 sustainable jobs, representing approximately 6% of VT's workforce. Together, we will achieve 100% total renewable energy (electric, thermal, transportation). Join REV at [www.revermont.org](http://www.revermont.org).

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# Wright Builders, Inc. Develops EarthKind Homes

*High-efficiency standards with low-embodied carbon for safe, healthy living with comfort in mind*

George Harvey

There are a lot of labels used to describe the energy efficiency of buildings. We can start a list with LEED-certified, net-zero, net-zero ready, and HERS index, and add more to it. It is confusing, and if the readers sometimes get confused about the labels that are used to describe buildings, we really cannot blame them.

Let's make things simple. There is one certification that is the toughest of them all. That is called "Living Building Challenge" (LBC). If builders want to get that certification for a project, they need to be ready to provide satisfactory answers to questions that go rather far beyond a blower-door test rating and the R-rating of a window. They have to be able to answer a question such as, "This two-by-four – where did the tree grow that it was cut from?" And no, this is not some sort of joke.

A few years ago, we got wind of the fact that Wright Builders, a company based in Northampton, Massachusetts, was actually building two buildings with the hope of getting them certified as Living Buildings. Assigned to look into that, I was curious about the fact that they were doing two at once. So I called the International Living Future Institute, which does the LBC certification, to find out how many organizations had done that. They had only certified about 25 buildings worldwide at that point, and they were clearly very surprised that one builder would have two buildings under development at the same time, looking for their certification. This was covered in the February 2018, issue of *Green*



EarthKind Homes Cape Promise. Rendering courtesy of Wright Builders.

*Energy Times*, in the article, "Green River Commons," (<http://bit.ly/GRCommons>).

There is a reason why we should consider this. Modern construction for efficiency is not the same as construction was in the past. An expert carpenter of 1950 would need considerable additional education to work on today's high-efficiency projects. The same is true of architects and engineers. There was a time when a house on the south side of a suburban street might have a picture window facing north, creating a heating drain. That time is fading into memory.

Building the high-efficiency buildings many people want today is not something that happens by accident. But as skills have been developed among the builders, the cost of such buildings has become ever more affordable by people of ordinary means. This is where things get exciting.

Wright Builders, which demonstrated unsurpassed ability when it built the Hitchcock Center and the Kern Center,

two LBC-certified buildings at Hampshire College, has been working on using that experience to develop a high-efficiency lineup of buildings called EarthKind Homes. All of these homes are built to high efficiency standards with low embodied carbon, they are designed to be places for safe, healthy living with comfort in mind. They have the features we might expect in high-efficiency homes, including double walls, triple glazing, and heat pumps. All take 10-kilowatt solar systems, and all will be net-zero consumers of electricity when solar is installed.

There are three EarthKind Homes designs at present. So Inclined is a 1,368 square foot model with a single sloped roof, three bedrooms, and 1.75 baths. Cape Promise, with 1,462 square feet of floor area, is a single-floor Cape Cod design. The True Story design has two floors for 1,760 square feet, with three bedrooms, 2.5 baths, basement, and a large garage.

According to Wright Builders, all three designs are "especially geared for households earning about 125% of the local median income." It is hard to know precisely what that means for any specific household. For example, median income is not the same as average income, and we suspect average income is considerably higher than median in this area. Also, people who are interested in building homes probably will have higher than average income. The advice we would give to anyone who is considering building a home is that they ask about EarthKind Homes.

Seth Lawrence-Slavas, Wright Builders' Vice President of Project Development, told us that the experience of building two Living Buildings and over ninety LEED certified buildings translated directly into an ability to design EarthKind Homes to be as affordable as possible. This means Wright Builders can reach a wider range of people looking to build a combustion-free, energy efficient, healthy and comfortable home. For example, when Wright Builders did its early work in this area, it was necessary to be certain that contractors understood what the challenges were and how the work had to be done. "Ten years ago, this was a specialty building," Lawrence-Slavas said. "Now our contractors understand that physical details matter."

We, at *Green Energy Times*, see this as a big step toward a better future.

EarthKind Homes' website is [www.earthkindhomes.com](http://www.earthkindhomes.com).

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The artist's renderings are for concept only and may not reflect actual construction details.



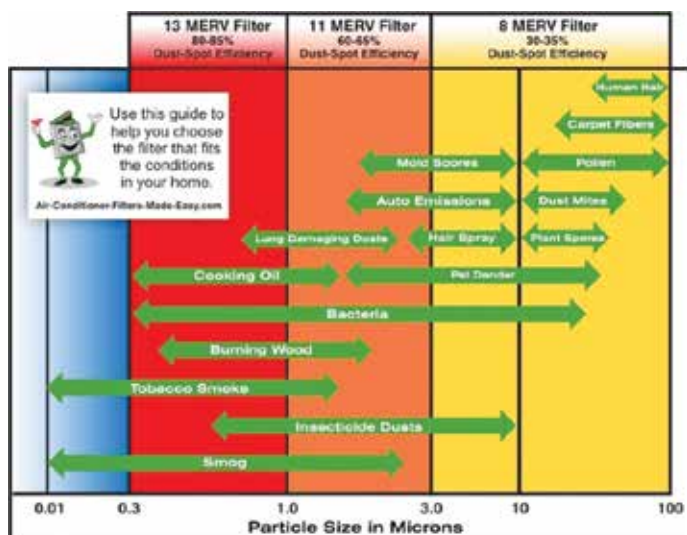
# THE GREAT INDOORS: CREATING A MORE HEALTHFUL AND SAFER BUILT ENVIRONMENT

Steve Winter Associates Team - Jayd Alvarez, Thomas Moore, Lauren Hildebrand, Maureen Mahle, and Peter Stratton

As humans, we spend a lot of time indoors. Studies by the U.S. Environmental Protection Agency indicate that under normal circumstances the average American spends over 90% of their life indoors. With the spread of COVID-19 and widespread voluntary and involuntary quarantine, the rise of work from home policies and new direction to social distance has resulted in a further increase to the amount of time we spend indoors. Now more than ever, people are cognizant of the air they're breathing and the surfaces they're touching. The buildings that we live, work and play in have impacts on our physical and mental health. With certain building and design considerations, we can make these impacts beneficial.

We recruited some experts at Steve Winter Associates (SWA) to fill us in on the various considerations when it comes to the health and comfort of a building, as well as some certifications that ensure these considerations are met.

## FILTRATION AND VENTILATION



Additional time spent at home is a good time to consider if our living environment is optimized to support our long-term health. One of the keys to a healthy living environment is high quality indoor air and the means by which we maintain the quality of our breathing air is ventilation.

Why do we ventilate buildings? 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, but not all techniques are created equal. Most buildings have exhaust-only ventilation systems. This type of system is characterized by local mechanical exhaust fans, operated intermittently, which typically remove air from the kitchen or bathroom. But where does the fresh air that replaces this exhausted air come from? If you have no idea, you're not entirely alone. In an exhaust-only ventilation system the living environment is likely assumed to operate under some gradient of negative pressure. So, the air that is replacing the exhausted air will be 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



Ventilation on a rooftop. All images courtesy of Steven Winter Associates.

some combination of the above. I think we can agree that it would be in our best interest to control the quality of the air we breathe; therefore, shouldn't we know its point of origin? And, if you don't know where your breathing air comes from, how do you filter it?

There is a better way. Continuous balanced ventilation systems, combined with air sealing and compartmentalization, provide more control over the air we breathe. In a continuous balanced ventilation system, air is constantly exhausted from the kitchen and bathroom at low volumes and is replaced with an equal amount of continuously supplied air from a known origin via a dedicated outdoor air duct. The living environment is pressure-balanced with an equal volume of supply air and exhaust air. As a result, the air in our breathing zone 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. There are additional benefits, such as decreasing transmission of odor, smoke, sound, and pests. With a continuous balanced ventilation system, and the appropriate compartmentalization and air sealing measures, we now own the breathing zone. We know the origin of our breathing air, and the inclusion of dedicated ducted supply air offers the opportunity for further quality control through filtration of supply air and the potential for heat and moisture recovery from exhaust air for optimized comfort.

Something else that you should consider, or rather do, is replace your air-handler filter and make use of the minimal efficiency reporting value (MERV) a performance rating, to determine if your system allows installation of a MERV13 filter which can remove particulate matter (PM) 2.5 and less.

- Written by Thomas Moore, Building Systems Analyst

## HUMIDITY

Thermal comfort – favorable temperature and humidity conditions – is fundamental to wellness and the proper functioning of any occupied space. When indoor environments are too warm, there is evidence of increased sick building syndrome symptoms resulting in occupants' negative moods, increased heart rate, respiratory symptoms, and overall feelings of fatigue. Relative humidity (RH) that is below 20% can cause dry eyes, skin, and mucous membranes. On the other hand, high relative humidity (above 70%) may lead to stuffiness or mold and fungus growth. Mold and fungi produce allergens (causing allergic reactions), irritants, and in some cases, potentially toxic substances (mycotoxins). In general, I recommend conducting regular inspections of roofing, plumbing, ceilings and HVAC equipment to identify sources of moisture and potential condensation. When moisture or mildew is present, immediately address the source and replace contaminated materials. Limit areas of the building that are routinely wet because of their use (think bathrooms and kitchens) and provide a means for drying them out when they do get wet.

This CDC study details the clear link between damp environments and respiratory illness.

Of particular interest now, viruses survive for longer periods at low humidity so it is even more important to maintain optimal relative humidity between 40% and 60%. If the RH in your home is too low and you have a humidifier, start running it. If someone in your home is self-quarantined, place the humidifier in the isolated person's room. Provide individual-level thermal control where possible.

- Written by Lauren Hildebrand, Sustainability Director

## BUILDING MATERIALS

The current pandemic brings us a renewed awareness of the materials in our homes and our environments. If you are like me, you are constantly tracking what you're touching. Also, you may be thinking about how a virus to remain viable longer on some materials than others, as some preliminary research indicates. Luckily, thoughtful and responsible choices can help increase our health and wellness as our household spaces become full-time work, education and play spaces.

How can what we are learning affect our materials choices for current and future buildings? First and foremost, think about cleanability. How easy or difficult is it to disinfect a given material with, say, soap and water, or a diluted bleach solution? (Note that while our 'green' cleaning protocols would not ordinarily include

bleach and the current coronavirus can be destroyed with

simple soap and water, there may be another virus in another time when we need to use something stronger.) How many grout lines or other transition materials are used, how cleanable are those transitions, and can we choose materials that minimize those transitions (such as continuous flooring or larger wall tiles)? We expect to see a renewed focus on cleanable materials that will ultimately improve health and durability under ordinary – and extraordinary – circumstances.

We also foresee a surge in anti-microbial 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 shown to interfere with normal human development and function. For that reason, we advocate such products for targeted use.

Another concept to consider is no-touch building finishes and amenities. It seems to me that in a post-COVID-19 world, we will be choosing touchless automatic door openers and elevator buttons, more lighting occupancy sensors, touchless water-bottle refill stations, and those touchscreens in the lobby or checkout counter will be a thing of the past. Hopefully, we will have a touchless handwashing station in every new building lobby!

- Written by Maureen Mahle, Managing Director, Sustainable Building Services

## UNIVERSAL DESIGN

As the goals of Universal Design suggest, an integral part of designing high performance spaces for all people regardless of age or ability includes 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. Addressing public health issues through design can contribute to promotion of overall health, avoidance of disease, and prevention of injury.

## SHARED GOALS AND DESIGN STRATEGIES

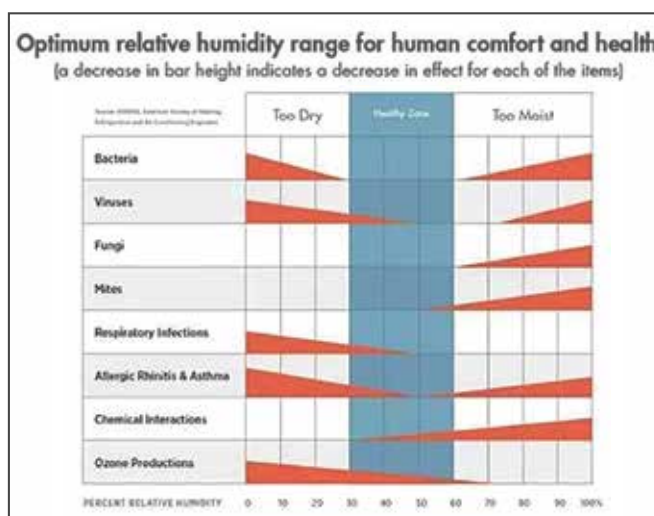
There are several shared goals and design strategies among health and Universal Design initiatives — the improvement upon ergonomics, sleep, safety, physical and mental health, among others – not only serve to create healthier environments, but can also contribute to better spaces for all building occupants. Moreover, the inclusion of health strategies

in design can assist individuals currently living with disabilities by mitigating chronic symptoms or preventing certain disabilities or injuries from occurring.

For more information about this topic, read the original piece in WBDG ([http://bit.ly/WBDG\\_UniversalDesign](http://bit.ly/WBDG_UniversalDesign)), and the article from WELL Building Institute at [http://bit.ly/WELL\\_UniversalDesign](http://bit.ly/WELL_UniversalDesign).

- Written by Peter Stratton, Senior Vice President, Managing Director, Accessibility Services

Reprinted with permission from Steven Winter Associates, Inc. April 16, 2020 blog at [http://bit.ly/SWA\\_GreatIndoors](http://bit.ly/SWA_GreatIndoors). ♻





# OpenSash: Retrofitting Existing Windows Since 2010

Christopher Pratt

I began repairing windows in Portland Oregon in 2007. It was good work, but climate change was steering people toward energy efficient replacement windows that didn't require storm windows. I was about to give up, until I discovered a method of adding a single pane of low-emittance (low-e) glass to the outside of the upper and lower sash of existing wood windows. The glass pane was simple to replace, affordable to apply, and didn't change the look or function of the windows from the original. It was based on the Marvin Window Energy Panel system that was introduced in the mid-50s and continues to be sold today. Being able to add glass panels to old windows in this way makes it possible to weatherize old windows to an efficiency level that compares well to modern windows with typical insulated glass

## How it Compares

The National Fenestration Rating Council (NFRC) test conducted on the Marvin low-e energy panel (EP) windows gives it a U-factor of 0.35. Modern argon-filled low-coated insulated glass units have U-factors that range from 0.23 to 0.30. To put this in context, the u-value of single pane glass is 1.0. Single pane glass with a low-e storm window is around 0.5. What is more tangible is how much warmer the inside surface of the glass is when the temperature is -20° F outside. Inside temperature is zero for single pane, 46 for the low-e EP, and 52 for a LoE2 272 argon filled insulated glass unit. Another major component to weatherization is air infiltration. It is hard for me to get laboratory professional quality air-change numbers, but this problem is cer-

tainly one that good seals, window sizing and good execution can solve.

## Cost is Key

These numbers are good but serving the needs of the many and reducing our carbon emissions for the many means making the OpenSash retrofit system affordable. After ten years of being in business, I have managed to keep the cost at about \$500-600 for a standard sized window. The cost of adding the glass runs about \$200 per window and the seals are another \$100. The rest of the cost is in restoration and repair.

This fall I participated in the most recent NESEA virtual trade show as one of the sponsors with my own booth. The 2020 theme was how to conserve carbon in the retrofitting of existing buildings, a natural fit for OpenSash. I made a lot of good connections; I was not selling new high-performance products or services. I was the only sponsor in the repair business, and I was alone in

my service. We did not share a common definition for "retrofit." In the commercial window world, a "window retrofit" means throwing the old windows out and putting new ones in. We don't save carbon if the new affordable replacement window cannot be repaired and has life span of 10-15 years.

The Keynote speaker at the NESEA conference, Rev. Mariama White-Hammond, was enthusiastically applauded for an address that put this simple question to us, "Who do you serve?" How do you answer that question when you are making a new high performance product that is unaffordable to most Americans? I do my best to targeted middle-to low-income people because that is where the greatest weatherization needs are and the greatest carbon savings are. I am less likely to appeal to wealthy clients who demand the highest performance modern replacement windows on the market.


Climate change mitigation requires that achieving window efficiency be



Above: Glazing a window at the Vermont College of Fine Arts in 2014. Photo: Jeb Wallace-Brodeur. Right: A window retrofit in 2016 at the Vermont College of Fine Arts in Montpelier, VT. Image: Christopher Pratt.



durable and accessible. Smaller, locally-owned businesses could be doing the job of window repairs, retrofits and weatherization for existing windows by aiming for a middle path in energy efficiency. The new green economy reduces material use, increases local employment, and makes quality repairable products. I have a great business plan for anyone who wants to get serious about window retrofit could do and be part of the climate solution.

Christopher Pratt owns OpenSash, a window retrofit company in East Montpelier, Vermont. More information on OpenSash can be found at [opensash.com](http://opensash.com). 



Two projects in central Vermont. Left: A typical double hung window in Barre; right: The windows they love to work on. This project was in Calais. Images courtesy of Christopher Pratt.

  
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# EXXON CARBON EMISSIONS AND CLIMATE: LEAKED PLANS REVEAL RISING CO<sub>2</sub> OUTPUT

George Harvey

In 1999, Exxon and Mobil merged to form ExxonMobil. The company, often still referred to as Exxon, has a history of scandals whose origins go back to the 1970s or earlier.

In October, 2020, yet another Exxon came into public view. The company was planning to increase its carbon dioxide (CO<sub>2</sub>) emissions. The increase was planned because Exxon expected to increase production, even as the demand for oil and gas was down worldwide and other companies in the industry were suffering economically. In what looks like denial of reality, the company saw increasing demand for its products for another twenty years.

Over that time, Exxon expects that its emissions will increase by 21 million metric tons. That represents a 17% increase from the emissions it had admitted to, bringing its total to 144 million metric tons. That is equal to the emissions from burning 16 billion gallons of gasoline.

Exxon's past scandals over its CO<sub>2</sub> emissions seem dreadful. Having been warned by Exxon scientists in the 1970s and 1980s that CO<sub>2</sub> emissions were warming the planet to an extent that would be dangerous, possibly "catastrophic," in the future, the company concealed the data and financed denial of climate change. But information on their denial of science was leaked in 2015. A timeline on the company's climate denialism through 2016 has been posted by Greenpeace. (<http://bit.ly/Exxon-denialism>)

Some of what was going on in the minds of people leading Exxon can be understood from things they said. Think Progress reported on May 30, 2013 that ExxonMobil CEO Rex Tillerson had posed a question at a shareholder meeting, "What good is it to save the planet if humanity suffers?" (<http://bit.ly/Tillerson-quote>) He told shareholders that Exxon's position was that the economy runs on oil, and it would continue to run on oil.



ExxonMobil oil refinery in Louisiana. Photo by WClarke, Wikimedia Commons. CC-BY-SA 4.0 <http://bit.ly/38OKcvq>.

The Think Progress article also had another observation worth mentioning. It reported, "A 2011 study found that '9 out of 10 top climate change deniers [were] linked with Exxon Mobil'."

The understanding of climate change and its probable trajectory has had widely different effects on companies in the oil and gas industry. At the one extreme, there is the example of Danish Oil and Gas, which has used the skills it built with offshore oil rigs to go into the offshore wind industry. It changed its name to Ørsted and disinvested entirely of its fossil fuel assets. Now, unlike companies in the industry it left behind, it is profitable.

Many oil and gas companies have started to move into renewable energy, at the very least. Some, such as Shell, are putting efforts into building charging stations for electric vehicles. Some discuss and even publicize building up renewable assets, but we have not yet seen if there is meaningful follow-through.

And then there is ExxonMobil. Even with the scandals, ExxonMobil seems not really to have any intention of changing its business plan, as we can see by its expectation of increasing emissions. October of 2020

came, and the problem had to be addressed.


There are three types of emissions that oil and gas companies might take into account, which we refer to as scope 1, scope 2, and scope 3. Scope 1 emissions are those that the company releases directly. Scope 2 emissions are those that the company causes indirectly when it buys energy, whether it be heat, electricity, or other. And then there is scope 3, which relates to all other emissions associated with consumption.

For an oil and gas company, fuel that it burns in vehicles or factories is included in scope 1. So is gas that is leaked from pipes or gas fields. Scope 2 is largely the electricity it uses. But that scope 3 includes all of the CO<sub>2</sub> emissions that result from its products, including emissions from our cars and trucks, our gas ranges, and oil burning furnaces.

Other oil and gas companies have reported on all three scopes, but not ExxonMobil, which preferred to regard them as not its problem. But the scandal of October seems to have ended that. A number of big shareholders were upset and they made the company release the data.

What we have now learned is what we all should have known. Exxon's earlier admitted CO<sub>2</sub> emissions are really only a fraction of the emissions that come from its product. Its Scope 1 and scope 2 emissions may come to 123 million metric tons now, but its scope 3 emissions are 730 million, according to an article in the Los Angeles Times. (<http://bit.ly/LATimes-Exxon>)

A case might be made that every person on Earth is a victim of the misdeeds of ExxonMobil. We are all its victims, even those of us who use its products, and even those of us who own shares in the company. If we have a question about what to do, perhaps the answer is obvious: Don't support Exxon. Don't buy their products. Get a heat pump, buy an electric vehicle, support local business that are going green.

Exxon was happy to ruin our planet. We should be happy to end that practice completely. 


## I Am Greta – Cont'd from p.2

She's right. Our leaders have failed us. Adults have lied to us. They have promised us long lives, bright futures, and a beautiful world. Most of them didn't lie to us on purpose - of course not. But for every well-intentioned individual, there is someone who attacks her, such as one journalist who claimed that she is a "mentally ill Swedish child who is being exploited by her parents and by the international left." We still have a long and difficult battle ahead of us persuading people, particularly leaders, to listen to science and take appropriate action.

But even when the world comes on board with reversing climate change, it won't be easy. As Thunberg says, "It's basically impossible to live sustainable today." I must concur. I would love nothing more than to live a completely sustainable life. However, for many people, it is financially and logistically difficult to practice an entirely eco-friendly lifestyle. Electric cars are still substantially more expensive than petrol cars. Entirely refraining from air travel is nearly impossible for many individuals. My grandparents live in Germany, for instance, and it's unrealistic for me to sail across the ocean when I visit. But that doesn't mean that we shouldn't try; there are measures that we can take.

When it comes down to it, however, what we really need is action from our politicians. For this reason, it's incredibly important to watch documentaries such as I Am Greta, in order to create informed opinions and urge leaders to take more steps towards protecting our planet. I Am Greta is both a captivating and educational documentary that could encourage more people to join the movement, and do what they can to help the environment.

Perhaps I was wrong to call Thunberg a "mere teenager" at the beginning of this review. She has proven over the past two years that she is more than that. She is an inspiration and a deeply passionate individual. Even so, all she can do is convince us that action is needed. One person can't change the world, but she can change our mindsets, and that is the first step to real change.

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

## TWO LIGHTS AT THE END OF A TUNNEL



John Bos

In a startling Tweet that went viral, Jodi Doering, RN, a nurse in South Dakota, described caring for Covid-19 deniers, patients who believed the coronavirus was a hoax. During a rare night off, she lamented on Twitter, "I can't help but think of the Covid-19 patients the last few days. The ones that stick out are those who still don't believe the virus is real. The ones who scream at you for a magic medicine. They tell you there must be another reason they are sick. They call you names and ask why you have to wear all that 'stuff' because they don't have Covid-19 because it's not real. Yes. This really happens. Their last dying words are, 'This can't be happening; this isn't real.' It just made me really sad."

Such can be the risk of a strongly held false belief in America today. You can hold onto a belief more tightly than to the facts that challenge that belief. You can hold onto it until your dying day.

We can hold onto climate denial more tightly than to the science that challenges that belief. We can hold onto it until our dying day.

Do we understand why and how people might change their minds about

the pandemic? Or our climate crisis?

We come to understand the world and our role in it by creating narratives that have explanatory power, make sense of the complexity of our lives and give us a sense of purpose and place. These narratives can be political, social, religious, scientific or cultural and help define our sense of identity and belonging.

Narratives are not trivial things to mess with. They help us form stable, cognitive and emotional patterns that are resistant to change and potentially antagonistic to agents of change (such as people trying to make us change our mind about something we believe). It's the mechanism that helps us to make sense of the world around us.

Together with other factors that shape our belief system, such as our personality, our genetic make-up and our habits, it becomes one of the strongest influences affecting any decision that we make. The way we interact with



others. The ways in which we react to any of the things that happen in our lives.

Following is a chilling example of a widely held false belief. In Australia, as well as our own western

United States, the massive wildfires are smoking-gun evidence of the severity of climate change. While climate change does not directly start fires (ignition sources do), climate change has created record-breaking hot and dry conditions. However, those who deny that climate change is real are saying that the Australian fires are not due to climate change at all but, instead, are due to an outbreak of arson. According to them, over 200 arsonists across the country intentionally started these fires. Some have even claimed that it's environmentalists who want to make it look like climate change is real when it isn't.

But there is light at the end of this dark and smokey tunnel. Americans, it now turns out, are nearly four times more

Cont'd on p.29



# WE ARE AT A CLIMATE CROSSROADS OF OPPORTUNITY



Dr. Alan K. Betts

We are at a climate crossroads. This is a time of real opportunity, when we can let go of the past, and do what needs to be done to deal with the climate, sustainability and extinction crises. The time for change is now, when new directions are possible.

The key questions to ask is, "Where do we want our Earth to be one year, five years and ten years from now? What must be done to get us there and are we willing to do it?"

This is critical because we are decades behind in reducing our greenhouse gas (GHG) emissions, which are driving the accelerating climate change.

We are at a crossroads for two reasons. The Trump regime has ended, and this coming year we should see the control of the Covid-19 pandemic with new vaccines. The pandemic has indirectly shown us the benefits of global reduction of greenhouse gases (GHGs) and reduced atmospheric pollutants, but we need the GHG reductions to continue at about three to four percent per year for the coming decade.

Considerable progress has been made in understanding the science of climate change. We follow in detail the rapid warming of the Arctic, the changing ocean circulations and the melting of the reflective ice that leads to increased ocean evaporation. We now understand how the Antarctic ice sheets are melted from below by warmer deeper ocean water. Icebergs then slide into the ocean contributing to

rising sea level. Underwater robots study the processes in detail.

The past year was, however, a disaster for the planet, with record tropical cyclones and hurricanes, record fires raging in the western U.S., and record temperatures continuing to melt the Arctic and the permafrost in northern Siberia. One town on the Arctic Circle reached 100°F near the summer solstice. The Gulf Coast states were hit by storm after storm, and Nicaragua was devastated by two category four hurricanes just two weeks apart. On November 1 the strongest super-typhoon ever hit the Philippines with 195-mph winds. In late November, northern Somalia, struck by the strongest cyclone of the satellite era, got a year's rainfall in 48 hours.

The Earth was close to a new record temperature in 2020. Tragically, as climate extremes are accelerating, millions of species are becoming extinct, threatening much of life on Earth. None of this news is encouraging as long as GHGs are increas-

ing. However, it also appears that if we can zero out our GHG emissions in the next decade or two, the recovery of the Earth's ecosystems will be much faster than we thought a decade ago.



A glimpse of the light: Pittsford, Vermont, December 1, 2020. Photo: Alan Betts.

Although the past two decades and especially the past four years have set us back, we have the technology to zero out our GHG emissions. This past decade there has been tremendous technical progress and falling costs in the development of solar and wind power, battery storage systems, and electric and hybrid vehicles.

However, fossil fuels have also become cheaper and their use continues, because society has been unwilling to use finan-

cial and legal strategies to push the fossil fuels out of the economy. For that reason the destruction of the Earth continues as it has for decades. We have the technical capability for transformation, but lack the political and economic will.

The political arguments will now change, but other obstacles will not.

One issue is that most of our economic system places no value on the future, so we are content to exploit and destroy our children's future to increase current profits. A related issue is that the consumer growth economy is central to our capitalism. But with nearly eight billion people on the planet, we have taken over nearly all the resources, and this exploitation is destroying the Earth's living ecosystems. Figures are uncertain, but it appears we are losing about 30% of the Earth's species each decade. A third global issue is that those with money and power control decisions as well as resources, and the poorer communities around the world suffer because they have no voice.

So what are we willing to do? We have to value the survival of the Earth and its ecosystems, and the lives of our children and grand-children more than we value the rights of the rich and powerful, and the consumer growth economy which is driving the current exploitation. We have the technical capability, and the renewable transition is vastly cheaper than trying to pay for the trillions of dollars of catastrophic damages from climate change in the next few decades. Will we really act?

Dr. Alan Betts of Atmospheric Research in Pittsford, VT is a climate scientist. Browse [alanbetts.com](http://alanbetts.com).

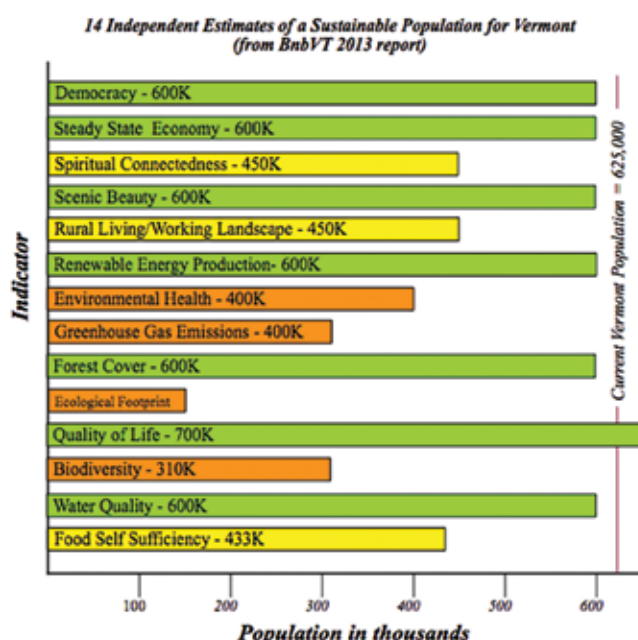
## Climate Refugees and Regional Sustainability

Wolfger Schneider

In the fall 2020 issue of *Green Energy Times*, John Bos familiarized the readership with "climigration" and the ever-increasing rate at which climate refugees in New England (NE) are seeking new safe havens. At our co-housing community in Vermont, we have seen a ten-fold increase in real estate requests within the last year from families seeking a cooler climate, smoke-free air, secure fresh water access, a safer place to raise children in the age of Covid-19, and less congestion. Most inquiries have been from the far West and the South.

Bos asked, "How are we to welcome and assimilate a growing population base in an eco-friendly way?" To answer that question, should we not first determine how sustainable our current state or NE regional population will be as we transition to a lower energy economy to help reign in global warming? How many more people could we shelter and feed from our local and regional resources and yet keep our quality of life and leave room for wildlife to survive?

In 2013, a report commissioned by Vermonters for a Sustainable Population, "What is an Optimum/Sustainable Population for Vermont," attempted to answer the report title's question. (The report is viewable under the Press tab on the [BetterNotBiggerVT.org](http://BetterNotBiggerVT.org) website). A sustainable human population within a geographically defined area would not exceed Nature's ability to supply renewable resources for human consumption and have the ability to process the resulting wastes in perpetuity.



For the last several years, Vermont's population has hovered around 628,000 (628K). Stable, yes, but not long-term sustainable, as we will see. Of the 15 indicators of sustainability presented in the report, let's look at three. The number in parenthesis indicates Vermont's population that can be sustained for the given category.

Food Self Sufficiency (433K). This sustainability number assumes today's diet and productivity per acre utilizing today's available cropland and fossil fuel derived energy. Crop rotation was assumed. It should be realized that this is an aver-

age assuming typical weather. A resilient number, considering variation in annual weather and long-term climate change would lower this number. The future decrease in fossil fuel usage will require more human and animal labor working on more local land to supply our food, as convincingly argued in Chris Smaje's new book, *A Small Farm Future*.

Ecological Footprint (150K). Assuming the 24 acres per person required for our current U.S. lifestyle and the available land in Vermont, we would have to reduce our

personal footprint by around 50% to be sustainable. Footprint analysis considers


land needed for agricultural, industrial, mining, fishing, transportation, housing, waste disposal, and activities.

Biodiversity (310K). This assumes present forest cover and fragmentation and land use. More people would impact land use, and the decline of fossil fuels may increase wood-energy harvesting for residential heating.

It can be argued that food self-sufficiency sustainability is most important to us humans. So, if we aren't sustainable with our current population, we certainly won't be with an influx of climate refugees. Yes, we may be short-term sustainable with food imports but not long-term sustainable with decreasing per capita energy availability and loss of local farmland.

It is important to strive for sustainability world-wide and to do so rapidly. If we want to avoid the cultural, racial, religious, and economic conflicts that can result from mass migration due to war and famine, as we are seeing around the world, we need to change our attitudes and beliefs on growth, both economic and population.

Cont'd on p.32



### Celebrate Lower Birth Rates and Less Consumption

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# A Question of Windows

Barb and Greg Whitchurch

Windows. Light. Views. A contrasting relief to the inside of our homes. Also, an added expense, a challenge to keeping the inside temperatures under control, a need for cleaning. But here, let's take a look at the efficiency aspects of window choices.

In general, the more efficient a window, the better its longevity, ease of maintenance, energy savings, and personal comfort. Today's best windows are triple- or quadruple-pane, triple-gasketed (no felt padding), Passive House-rated, have U-values well below 0.20 (R-6 or better) (ours are U-0.11 or R-9); and air infiltration well below 0.30 (ours are 0.03). These attributes help keep a home warm in winter and cool in summer.

Up here in the North, where we want our south-facing windows to bring in solar heat in the winter, the Solar Heat Gain Coefficient (SHGC) should be above 0.45. (Our windows are 0.62.) By contrast on the east and west-facing windows, we probably don't want the summer heat to come into the house, and there is no appreciable sun there in the winter, so a lower SHGC is a good idea. Regardless of SHGC, south- and west-facing windows should have shading for the summer such as leafy trees, vines, awnings, and so on.

In the building industry nowadays, the terms "energy efficient" and "high performance" are tossed around quite cavalierly. Advertisers are hoping that people will jump to conclusions and not ask the hard questions. Any window supplier who hesitates to provide the above-mentioned specifications should be avoided.

Simply claiming that a window is

"top of the line," "new and improved," or "ultra-high efficiency" doesn't say enough. Likewise, claiming that a window has double-thick glass, one inch or better thermal pane or triple-pane, is low emittance (low E), with argon gas, or has foam-filled frames, is not sufficient. A friend of ours recently got a quote for some windows from a very well-known company that advertises heavily. But when he took the trouble to look a little further, he found that he could get Passive House-rated windows with better specifications for less money.

H. Sloane Mayor ([bit.do/hsmayor](http://bit.do/hsmayor)), one of the principals at MAKE Architects in Hanover, NH, renovated her older home in Hanover with a deep energy retrofit (DER). Among the many decisions she faced was that of choosing window replacements.



Above: the outer envelope upgrade was well underway during the summer, with taped Kohltech windows and Huber Zip System sheathing. Right: the inside envelope of Intello variable permeable membrane with Tescon Vana acrylic tape for air and moisture control. The two right Kohltech windows are both operable. All photos: courtesy of H. Sloane Mayor.



Center in White River Junction, VT ([www.LoewenVTNH.com/](http://www.LoewenVTNH.com/)). Other Kohltech placements include Summer Park Residences in Hanover, NH ([bit.do/summer-park-res](http://bit.do/summer-park-res)) and the Bente Building at the AVA Gallery and Art Center in Lebanon, NH ([bit.do/ava-bente](http://bit.do/ava-bente)).

A little deeper dive: although most people understand the importance of insulation, did you know that most older homes lose more of their heat through air leaks than through lack of proper insulation? In Sloane Mayor's DER, the Kohltech windows support the overall insulating and air-tightness targets, allowing the home to switch

over to heat pumps for heating and cooling. Note that the window installers must be trained in modern techniques to assure that they don't compromise airtightness with old-school installation shortcuts -- here, membranes and acrylic tapes come to the rescue.

As architects know, upfront cost increases, if any, are quickly offset by energy savings alone

*Cont'd on p.29*

Previously, in her design of the 2018 U.S. Green Building Council (USGBC) NH Chapter Building of the Year, a LEED Silver DER private residence for a client, she had specified Passive House-certified Kohltech windows, which had performed incredibly well and had greatly pleased the owners ([bit.do/han-river-house](http://bit.do/han-river-house)). So, she chose Kohltech for her own home.

Both of these projects were contracted by O'Hara and Gercke (<https://OHaraGercke.com/>), and the windows were acquired through Loewen Window



Project Image: Nelson Cabin - courtesy Stefan Hamden of G&S7 architecture

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Cont'd from p.28

-- even without considering the health, comfort, safety, environmental benefits, and the increase in the home's value. Mayor's design, material, and appliance choices have created a highly efficient, all-electric home that uses heat pumps (also providing hot water) instead of a furnace or boiler, and will cost very little to run and maintain. In such an all-electric home, on- or off-site solar PV can be leveraged to provide all of its energy cheaply and sustainably.

Our own 2001 home was "high performance" when it was built; in 2014 we built a Passive House (PH) addition.

The two are connected with an enclosed breezeway. Last fall, we replaced all 110 square feet of Andersen thermal pane low-E, argon-filled, circa 2000 windows in our kitchen with PH-certified Klearwall windows. The difference has been striking. It's quieter; we're using far less firewood (we heat only with woodstoves); we can shut down our stoves and don't have to reload during the night; the house is noticeably warmer when we get up in the morning. No question about it!

Barb and Greg are board members of VTPH.org and have their Passive House in Middlesex, VT [bit.do/phc-vtbiz2](http://bit.do/phc-vtbiz2), [bit.do/mdx-mec-bldg](http://bit.do/mdx-mec-bldg). 🌱

## END OF A TUNNEL – Cont'd from p.26

likely to say they're alarmed about the climate crisis than to be dismissive of it. That's the highest ratio ever since the Yale Program on Climate Change Communication (YPCCC) first began gathering data on American attitudes about climate change back in 2008. According to survey data released on October 9, 2020, more than a quarter of the U.S. adult population, 26%, now thinks global warming and its attendant consequences are alarming. That's more than double the 11% who were alarmed back in 2015, and almost four times the 7% who currently say the climate isn't changing.

Another light in that tunnel is President-elect Biden's appointment of John Kerry as our nation's presidential

envoy for climate who will sit on the National Security Council (NSC), the first time the NSC has ever had an official dedicated to the climate crisis. Climate change is a world-wide, not just a national issue. As secretary of state, Kerry played a key role in negotiating the Paris agreement, which was adopted by nearly 200 nations in 2015. Trump withdrew the U.S. from the Paris agreement, and Biden has pledged to rejoin it on his first day in office.

John Bos is a contributing writer to Green Energy Times. He has written about his concerns of an endangered environment for the past ten years. Your comments and questions are invited at [john01370@gmail.com](mailto:john01370@gmail.com). 🌱



Siding and the new porch and deck have been added onto the back of the house as winter came.

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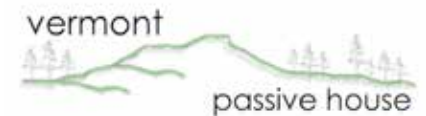


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# Just A Bunch of B.S.\* (\*Building Science, of course) – FROM UP ON THE ROOF

Nate Gusakov

The toolkit of an energy auditor is a fascinating collection of building science technology: infrared cameras, Wi-Fi-enabled digital manometers, blower doors, fog machines and combustion analyzer. It's a lot of cool technology. Most of it runs on batteries or needs periodic calibration or has sensors that fail or software that glitches. However, there is one completely free, fail-safe method of seeing exactly where heat is leaking upward out of a house, and it should be used by any well-trained New England energy consultant. All you need is one-half inch to six inches of snow and a day or two of calm, cold weather. What is this method? Looking at the roof.

As heated air escapes upward from a

house, most of it comes into contact with the underside of the roof sheathing, before it can make its way into the sky. Where it does so, it warms up the roof, and this means that the snow atop the leaky areas melts much faster than snow on well-insulated areas. The result can be a near-perfect 'fingerprint' showing where heat is leaking from the house below. I first heard about this method at the Better Buildings by Design Conference put on each year by Efficiency VT, and I've made use of it ever since. The pictures are examples from around northern Vermont:

Picture 1 - Most of this roof is well-insulated and shows even, consistent snow cover but melt patterns in the middle tell a different story: When the gable addition (on


the right) was built, its roof was only insulated as far as the original eave (bottom of the roof at left). The 'dead' space between the two living areas is open to wall cavities below but has no ceiling or rafter insulation. Warm air from the house comes up through the wall (remember our old friend the convection loop?), has free access to the underside of the roof in that area, and consequently warms it up enough to melt the snow. You can even see the line of a rafter in the middle of the melted section. That six- or eight-inches-tall wood rafter provides more insulation to the roof than the one inch of wood roof decking around it, and therefore the snow directly on top of the rafter melts more slowly than the area around it, marking the rafter's location. The level of detail that can be shown on roofs in this condition is amazing. When the weather is right, a quick walk around the outside of your house can show you a lot about where the air leaks are in your building envelope.

Take a look at the example in Picture 2: The bare section roof on the left is south-facing, and has been melted by sunlight. What's the story being told by the melt pattern on the addition with the swooping porch roof? Line 1 corresponds to the top of the interior wall. Everything below line 1 is dead space over the porch roof, 'outside' the thermal envelope of the house. No heat



Picture 2: The bare section roof on the left is south-facing, and has been melted by sunlight.

from below means no snow melt. Line 2 corresponds with the ceiling of the second floor. Everything above it is attic space, and as you can see (especially on the left side of line 2), heat escaping into the attic is melting snow more quickly above that line. In between the two, is a sloped ceiling, with some insulation in the rafter bays. What about the big melted stripe in the middle? In this case, the culprit is an interior wall at Line 3. There is still fiberglass insulation across the entire sloped ceiling, but whereas most of the ceiling is air-sealed from inside relatively well by the painted sheetrock, the wall framing cavity was never air-sealed at the top so it acts as a chimney, bringing warm interior air right up to the roof plane where it passes through the fiberglass and melts the snow.

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



Picture 1: Most of this roof is well-insulated and shows even, consistent snow cover but melt patterns in the middle tell a different story.

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# Efficiency Vermont's EEN Contractor Spotlight: Montpelier Construction of Barre, Vermont

Interview with Malcolm Gray, Founding Partner, by Green Energy Times Staff



Malcolm Gray,  
Founding Partner of Montpelier Construction  
located in Barre, Vermont.  
Courtesy photo.



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## 1. WHAT IS YOUR AREA OF EXPERTISE?

I've been building energy-efficient homes since the late 1970s. The definition of energy efficient has been a moving target the whole time. We keep getting more ambitious, and now we are talking about building energy-positive structures (zero energy homes that are so efficient, they produce more energy than they consume). I have been a Home Performance with ENERGY STAR (HPWES) contractor since 2006 and a certified Passive House consultant since 2015. Montpelier Construction has built a number of Passive House certified projects, along with Efficiency Vermont's (EVT) High-Performance program.

## 2. WHAT PROJECTS DO PEOPLE TRY TO DO THEMSELVES THAT REALLY SHOULD BE DONE PROFESSIONALLY?

Building high-performance structures can create difficult balance points. A professional should be consulted to avoid moisture problems, determine where you insulate and how much, and to ensure good air quality and human comfort. Montpelier Construction can manage those issues with the latest techniques and products. Our Efficiency Excellence Network (EEN) certification tells clients that we have the training to successfully complete complex projects.

## 3. IF YOU COULD ONLY CHOOSE ONE TYPE OF PROJECT TO REDUCE SOMEONE'S CARBON FOOTPRINT OR IMPROVE EFFICIENCY, WHAT WOULD IT BE AND WHY?

EVT's High-Performance program gives us a path to building comfortable, low-carbon homes. We evaluate our choice of materials and mechanical systems to reduce carbon while creating comfortable spaces for our clients. Montpelier Construction looks at all the unique condi-

tions in each project, creating the best combination of materials and systems, so clients get the best product and highest satisfaction.

## 4. WHAT IN YOUR FIELD OF SPECIALTY IS MOST VALUABLE FOR OUR READERS TO KNOW?

Montpelier Construction uses the latest building science and best available products and systems to ensure our clients get the highest quality finished project. Through our certifications and constant training, we keep up-to-date on all the latest technology and knowledge.

## 5. WHY SHOULD PEOPLE USE AN EFFICIENCY EXCELLENCE NETWORK (EEN) CONTRACTOR OVER SOMEONE ELSE?

As an EEN member, we have been vetted to always use building science and the highest levels of best practice. EVT offers trainings in a wide range of the latest building science topics, keeping all of us abreast of the leading technologies and products.

## 6. WHAT ARE THE BEST WAYS TO FINANCE PROJECTS (OR WHAT INCENTIVES ARE AVAILABLE) FOR RESIDENTIAL OR COMMERCIAL PROJECTS?

There are low interest loans available,

some with even lower interest rates for low- and moderate-income households. Vermont State Employees Credit Union (VSECU) offers the Home Energy Loan at very reasonable rates. Doing the work through a certified EEN contractor gives our clients access to this loan and others. Montpelier Construction is always kept up-to-date on any incentives through EVT, utilities, and any state or federal programs. [Editor's note: see the Incentives section on page 14 and 15 for more details.]

## 7. WHAT ARE SOME QUESTIONS YOU RECOMMEND CUSTOMERS ASK WHEN SELECTING SOMEONE TO DO WORK TO MEET ENERGY EFFICIENCY GOALS?

Montpelier Construction gives prospective clients our referral list, suggesting which completed projects would match some of their needs. We suggest asking about how it was to work with us, how we problem solved together, did we stay on budget, how knowledgeable we were in the various trades and products that go into reducing their energy needs. ♻️



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# CONCORD COUPLE WINS NHSaves NET-ZERO PRIZE

George Harvey

In early January, Nancy Rae Mallery, the publisher of *Green Energy Times* spoke in a very brief interview with builder Bob Irving. The questions and answers went as follows:

**NRM:** Did you know we are planning on publishing an article about the place you built in Concord that won the net-zero award? I recall your initial hopes of getting this job. All I can say is what an amazing job you did! Congratulations.

**BI:** You are too nice. I reached a good place where those houses aren't amazing, they are just the same-old thing. That's where I wanted to be.

**NRM:** Isn't that exactly how it should be, with all buildings being net-zero?

**BI:** Exactly! That's what I mean.

So here is the story of a house that is not amazing to Bob Irving, but it won an award because it is, well, amazing.

Carol Voloshin works for Stonyfield Organic. Dan DiPiro had also worked there for eight years starting in 2006, when the company's roof was covered by the largest solar array in New Hampshire. The experience of working for an environmentally-friendly business, now a certified B-Corp had its effects on them.



NHSaves Drive to Net-Zero Competition third-place home in Concord, NH. Courtesy image from R. H. Irving Homebuilders.

When Carol Voloshin and Dan DiPiro wanted to build a new home, they had some rather remarkable goals in mind. Voloshin wanted to be very near water, and DiPiro wanted their home to use net-zero energy. So, they built a net-zero home on land on the Contoocook River in Concord, New Hampshire.

This was a structure that had its share of challenges. Because it was built so close to the river, actually in the flood plain, the home had to be elevated ten feet to reduce any risk of water problems. This meant that the first floor had to be specially designed to be supported by a set

of trusses, and insulation under it had to be unusually thick. Bob Irving said he wanted the insulation under the floor to be in the same range as the roof, which is R-64.

The walls are also insulated with packed cellulose, to R-37. As double-stud walls, they have almost no thermal bridges. The home has triple-glazed Logic brand windows to retain heat as well as possible.

Special care was given to air-sealing, which Irving says can make the difference between an attempt at efficiency and a great house. This means that good ventilation is vital, and the house has a Broan heat recovery system. Since there is no basement, the water heater

had to be on the first floor, and a Rennai Marathon heater was chosen for that role.

The heating system is more complex. A pellet stove can provide all the heat, but it may not be necessary to use it on any but

the coldest nights. There is a three-head heat pump system in the house which can do heating and cooling through most of the year.


As efficient as it was, the house had not yet achieved the net-zero status DiPiro had hoped for. The Home Energy Rating System (HERS) rating was 44, which meant it was 56% more energy efficient than a standard new home.

Net-zero status came with a rooftop solar array installed by ReVision Energy, which has offices in Maine, New Hampshire, and Massachusetts. ReVision installed thirty solar panels to produce an array of 9.15 kilowatts. The energy from this array contributes about 10,000 kilowatt-hours of energy each year to cover the household energy needs. And with that, the HERS rating dropped from 44 to -3, meaning that what had been a very energy-efficient structure was now net-positive.

Voloshin and DiPiro now live in a house that creates more energy than it uses. This is not amazing. We knew it could be done. But they were the ones that did it, with some help from R.H. Irving Home Builders, ReVision Energy, and some others. What really should happen with every home actually did happen, and perhaps that is amazing.

Certainly, the people at NHSaves seem to think it's amazing. The Voloshin-DiPiro house won third place in the NHSaves Drive to Net-Zero Competition. Our congratulations to all.

R.H. Irving Home Builders' web site is [rhirvinghomebuilders.com](http://rhirvinghomebuilders.com).

ReVision Energy's web site is [revisionenergy.com](http://revisionenergy.com). 




Interior with triple-glaze windows. Image: NHSaves.

## Climate Refugees and Regional Sustainability

Cont'd from p. 27

Fortunately, there are recent reports of positive trends. A 2020 national survey by the Center for Biological Diversity found that three out of four Americans think the world's population is growing too fast. Sixty percent said population growth and consumption are responsible for the rapid loss of species biodiversity. In a November 2020 a study published in the journal, *Climatic Change*, about how potential parents view the future: 59.8 per cent of respondents reported being "very concerned" or "extremely concerned" about

the carbon footprint of procreation, and a stunning 96.5% were very or extremely concerned about the well-being of their existing, expected, or hypothetical children in a climate-changed world. Interestingly enough, should we be able to zero unwanted births today, we would nearly stabilize the U.S. and world population.

*Schneider is currently President of Better Not Bigger VT. He retired to Vermont after 40 years at the Johns Hopkins Applied Physics Lab. He hopes that Vermont can avoid the growth mania that has so changed Maryland.* 



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# SUSTAINABILITY AT GOLDEN BROOK ELEMENTARY SCHOOL

Barb and Greg Whitchurch

The Golden Brook Elementary School project, in Windham, NH converted an overcrowded, "vintage" facility into a new facility that supports a safer, more effective learning environment. The designers incorporated as many energy-efficient features as possible within budgetary limitations.

This colorful, light and functional building (pre-school through fourth grades) was the result of innovative teamwork and a shared creative vision held by the school district, Banwell Architects (BanwellArchitects.com) of Lebanon, NH and Quechee, VT, and DEW Construction (bit.do/dew-gbs) of Williston, VT and Keene, NH.

Rooms are arranged by grade, each with a signature color and geometric shape. This enables young students to easily find their way inside the building and reinforces a sense of community by age group. Flexible spaces, designed to support collaborative learning, are woven throughout the building. Design features include an open and sunny main lobby and administration area, natural lighting in all instructional spaces, and improved traffic design to relieve congestion.

These design efforts were rewarded with an Outstanding Project Award in Learning by Design magazine's fall 2020 Educational Architecture and Interior Design Awards for Excellence (bit.do/gbs-award).

Banwell, along with the Fitzmeyer & Tocci Associates (bit.do/f-t-gbs), applied their considerable expertise and experience to provide as many high-performance design features and efficiency strategies as possible. The total construction cost was \$28.8 million, and the project was completed under budget and on time. Below are just some of the low-cost, cost-saving sustainability features the design team was able to fit within the budget:

- Created a two-story building, reducing the building footprint and preserving land spaces for other uses
- Recycled 75% of the construction waste of typical endeavors (three to seven times what is typical)
- Re-used land and minimized demolition by re-using part of the original building; (A small kindergarten wing was retained and incorporated into the modern school.)
- Avoided using inefficient temporary classrooms through "staged" building. (One third of the new building was constructed on the new footprint; students were then moved into that building; then the remainder of the existing building was demolished and replaced.)
- Minimized impervious surfaces, such as driveways, the parking lot, and other paved areas, to allow precipitation to enter the ground
- Potable water will not be used for irrigation
- Trees in the parking lot reduce the "heat-island effect"



Award-winning Golden Brook elementary school. Photos: Ryan Bent Photography.



Functional classroom with views to the outdoors.

- No-idling policy near the school minimizes exhaust dangers
- Recycled, eco-friendly, and low-VOC materials used for furniture, playground structures, and flooring

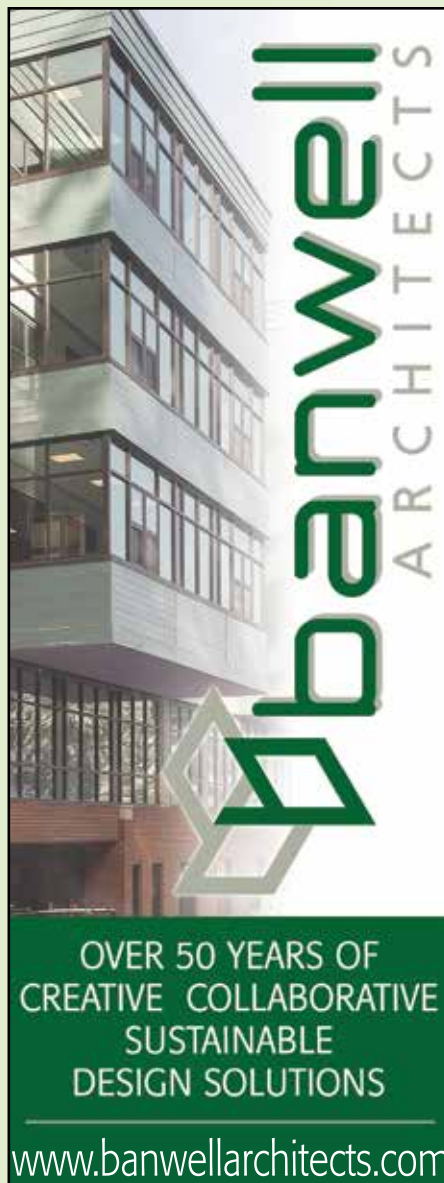
- Low-maintenance, eco-friendly indoor surfaces requiring only minimal and non-toxic cleaning and maintenance
- 70% of the spaces in the building have outside views
- New low-temperature hydronic heating
- Eco-friendly engineering of HVAC, avoiding typically necessary air conditioning
- Variable air flow and low-energy motors in the HVAC systems

Cont'd on p.37



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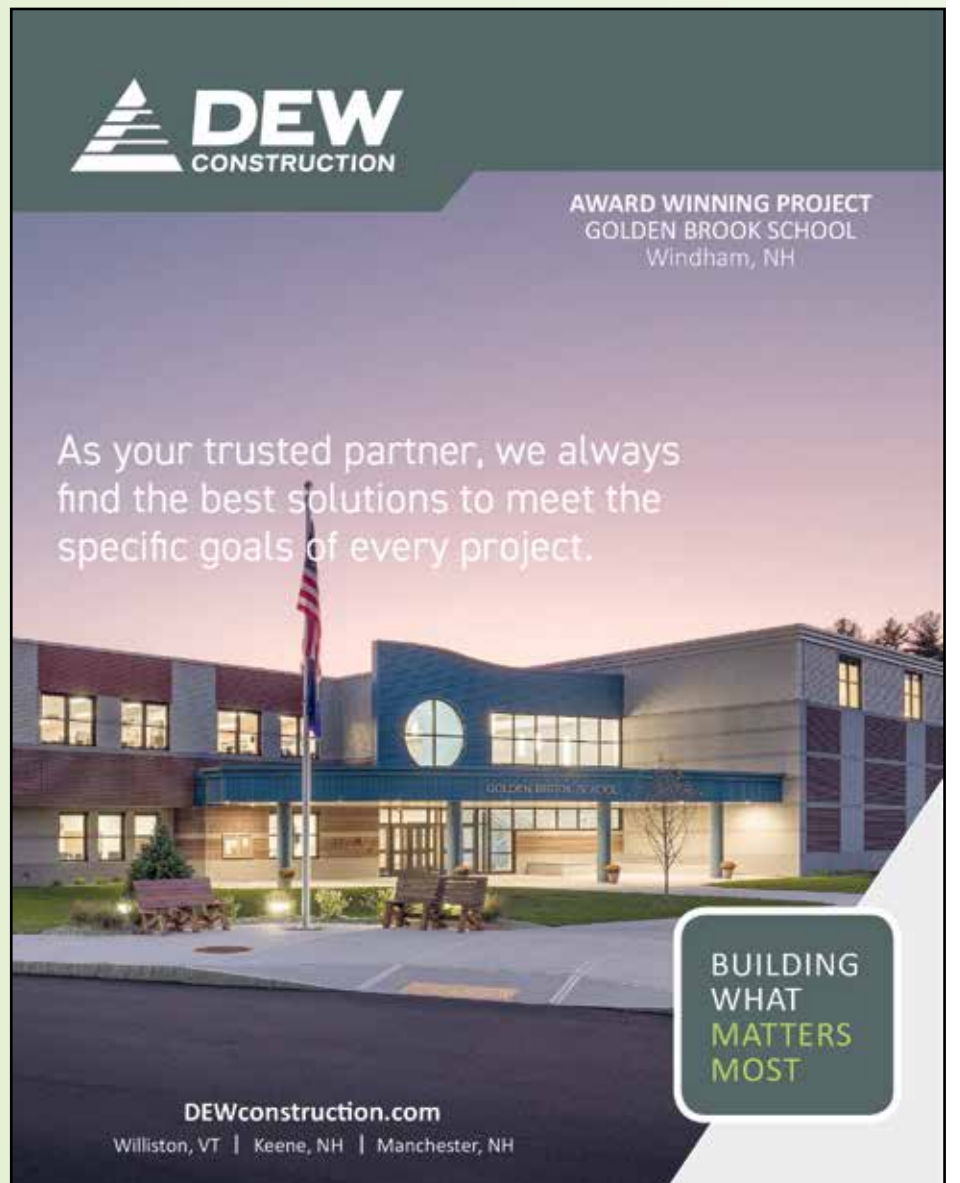
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Larry Plesent

## Ingredient of the Month Your Brain on Science

Contrary to popular opinion, science is not a collection of facts and immutable truths or laws. Rather science is a method of inquiry; a system designed to inch us closer and closer to increasingly accurate understandings of the universe that begat us and to which we belong 100%.

Cool beans! So why isn't everyone as excited about science? Why wouldn't like, everyone wants to work with science? Or at least pay attention to it?

The answer to that, in my opinion, has nothing to do with shortcomings of the human brain and everything to do with the shortcomings of the way we look at and teach science and technology.

I take issue with the way science is broken up into different categories and specialties. There are way too many "ologies" going on. And each one has its own words, its own language, and its own nerdy rules of engagement.

You should not have to learn a whole new language, just because you want to understand your world a little bit better. That can come later, in advanced education, should one choose a specialty at that time.

What I am suggesting instead is a radical shift in what and how we conduct our education.

Since science is not a body of facts, and facts are ridiculously easy to find in this smart-phone age, it is clearly more important to teach methods of

problem solving than fact memorization. How brains learn and adapt, and especially how YOUR brain learns and adapts, dovetails with the learning of techniques of problem-solving. Now add "centering" techniques to control anxiety and stress and throw in some meditation instruction.

I suggest that fourth grade be devoted to this type of self-understanding curriculum, along with continuous developing of the child's language and math skills.

The pre-fourth years should focus on instilling inner joy. Joy of learning. Joy of exploring and experiencing, joy of understanding, of reading and music, of math and puzzles and thinking. Joy of living and of being human. Is there anything more important to learn than that?

Skip the lists of facts and dead language nerdiness. Let's start turning out happy, relaxed brains that know how to function in changing environments --brains that know how to solve issues, to learn and to adapt. Let's turn out science-friendly lifelong-learner brains that seek to understand how the world operates and how to best live

successfully within our ecosystem.

What we need are brains to function as forces for positive change and for our inevitable evolution to a sustainable society. The kind of brains that will turn this mess around.

Larry Plesent is a writer, soap maker, grandfather and business guy living and working in the Green Mountains of Vermont. Learn more at [www.vtsoap.com](http://www.vtsoap.com). ☘



image: youreyeonthefuture.wordpress.com

## MEETING THE CLIMATE CHANGE CHALLENGE:

### Maine Grange Farmer's Initiative Sets Its Bar High

Toby Martin

The Maine Grange Farmer's Initiative, formed this past August by two members of the Maine State Grange, Toby Martin of Islesboro and Steve Verrill of Poland, is stepping up to take a leadership role by showing how farmers in Maine can join other Mainers in a common effort to overcome global warming through Maine's growing awareness and increasing focus on climate control, energy and the environment.

Though the Farmers' Initiative has just begun its work, its core concept of uniting growers and support systems of all stripes together is one that also may have potential to reach beyond the Pine Tree State and find common ground in New Hampshire and Vermont.

Martin, a member of Valley Grange in Guilford, is chair of the Islesboro Energy Team, which focuses on community energy in the for-profit and nonprofit sectors and holds an annual regional energy conference, and he also sits on the Islesboro Energy Committee, which is responsible for Islesboro's municipal energy efforts

in collaboration with the island's Select Board. Verrill, a third-generation farmer who raises vegetable and fruit crops as well as beef cattle, served as CEO (president/state master) of the Maine State Grange, now sits on the Maine State Grange's five-member Executive Committee, and is president/master of Poland's Excelsior Grange.

The Grange has been around a long time. It began just after the end of the Civil War, driven by the social and economic needs of the nation's farmers, who built Grange halls where widespread farming families could gather. The Grange gained national strength, developed farmers' cooperatives, challenged businesses, railroads, and advocated for rural progress, including rural free delivery of the mail.

The Maine Grange Farmers' Initiative aspires to be Maine's 21st century equivalent of what the Grange accomplished in the 19th century. Its mission, like that of the parent organization, is to "strengthen individuals, families and communities through grassroots action, service, education, advocacy and agriculture awareness."

## ELMORE ROOTS' PERMACULTURE KNOW-HOW

### What is it About Flowers?

David Fried

In every snowflake there is a flower waiting. Flowers, when they fade away, become seeds for snowflakes. Snowflakes, when they fall, become flowers when they melt. How else to explain the softness of fresh snow and the warmth of flower petals against the cheek? Snow, nearly absent of aroma, gives way to flowers with the most!

How does everything stay folded up inside the blossom? All that color and all that fragrance? Deep in the earth all winter or inside the buds on a tree or shrub, waiting, like all of us, for a warm morning, a friend to call. Someone walking by to smile at us. The flowers are all of this and more. Soul food. They nourish our dreams and caress our faces and our spirit.

Here in northern Vermont our hills are alive. Crocuses and snow drops, tulips and grape hyacinths, pussy willows, forsythia, azalea, apple blossoms, calling us out to dance with them and around them, twirling, breathing, full of life like they are.

I put on the record album from the 1970s by Donovan, A Gift from a Flower to a Garden. My daughter, raised in an era of CDs says to me, "It was just the other day that I realized you could turn them over."

Flowers tell us to wake up, it's spring again! They remind us to be gentle. They help us to slow down, to appreciate beauty.

Someone invented a flower clock so you can tell what time of year it is by what flowers are blooming. Here in Elmore, if pussy willows are out, it's early April. Juneberries and forsythia? Late April. Flowering crabs? Late May. French lilacs? Early June. Canadian lilacs, two weeks later. Roses? Mid-late summer. Our calendars could have names of flowers instead of



Photo by artist by Joyce Dutka

months. "I'll meet you on the third day of elderberry blossoms." It would be fun and relaxing to see if we could meet then. Probably the only reason we have names of months on our calendars is because not everyone has the great fortune to be surrounded by all kinds of flowers, all the time.

We can plant things to give us flowers from April

through September. Did you know that when you plant shrubs and trees, they can keep flowering for twenty to over one hundred years, and you only have to plant them once? We can plant flower seeds and bulbs and bedding plants very close to our houses and places we sit. We can plant them along our walkways and at the sides of our entrance steps. We can give flowering plants as gifts, and we can make bouquets and give them to our neighbors for any or no reason.

There is a saying that the world is in a rough state right now because of senseless hatred.

And harmony and peace will be restored by loving each other for no reason.

David Fried walks and works among the flowering trees and shrubs at Elmore Roots Nursery in Elmore, Vermont. ☘



members in Maine, many of whom make up the state's pool of new, experienced and retired farmers, the potential for the Farmers' Initiative appears both promising and relevant for Maine.

The Farmers' Initiative, working with Grangers and others around Maine, is committed to doing its part bringing people together to carry out its mission, working for Maine's growers, consumers and economy, in conjunction with offsetting negative climate issues. It has already begun, and has caught the attention of the leadership of the National Grange's headquarters in Washington, D.C.

A member of Valley Grange in Guilford, Toby Martin is co-founder of the Maine Grange Farmers' Initiative. He works with nonprofit organizations whose missions drive grassroots community involvement in Maine and New England. He lives in Islesboro, where he represents groups involved in energy, the environment, the library, arts and culture. He is a published poet, playwright, essayist and editor, and contributes regularly to online and print media. You can reach him at [mtm.tpsmail@yahoo.com](mailto:mtm.tpsmail@yahoo.com), and view the Maine State Grange website at [mainestat-grange.org](http://mainestat-grange.org). ☘



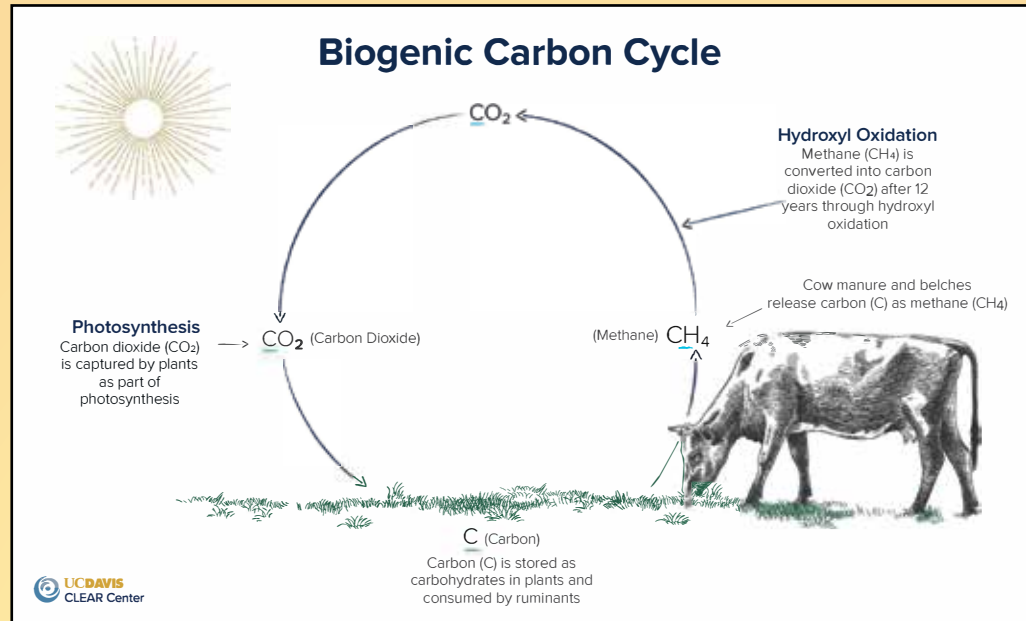
# Livestock Methane, Perspectives and Progress

Jessie Haas

The climate in which we developed our civilization was shaped by grass and the animals that ate it. Co-evolving, grass and grazing herds built enormous stores of carbon into the soil, cooling the planet. Now, humans are entertaining the idea that methane produced by cows is a major force in warming said planet, and that we must reduce their numbers or emissions. Possibly, but let's put things to perspective.

Methane ( $\text{CH}_4$ ) is a short-lived greenhouse gas (GHG) about 25 times more potent than  $\text{CO}_2$  if measured over a 100-year period. But more crucial is the more immediate effect after it is emitted, and before it decays. Methane that makes its way into the atmosphere has 84 times more global warming impact over a twenty-year period than  $\text{CO}_2$ . Ruminant livestock emit – mainly through burping – about 80 million metric tons of  $\text{CH}_4$  a year, about 28% of human-generated  $\text{CH}_4$  worldwide.

But if cattle burps represent 28% of emissions, where is the rest coming from? Turns out that another third of global methane emissions is directly attributable to North American gas production. That's right – the very profitable fossil fuel industry on this continent emits as much methane as all the world's cattle, sheep and goats put together. And fossil methane is worse for the planet. Here's why. Plants grow by absorbing atmospheric  $\text{CO}_2$ . When plants are eaten, some of that carbon is released as methane,  $\text{CH}_4$ . It returns to the atmosphere, where it remains for twelve years before breaking down into  $\text{CO}_2$  and water, available to grow more plants as part of the biogenic carbon cycle. There is no net gain of greenhouse gases. Fossil methane, however, is new to the atmosphere, and contributes to the increase of GHGs and rising tem-



Biogenic Carbon Cycle. You can learn more about this graphic at [www.bit.ly/UCD-C-cycle](http://www.bit.ly/UCD-C-cycle) A video discussion with comments from UC Davis CLEAR Center's director is at [www.bit.ly/Rethink-CH4](http://www.bit.ly/Rethink-CH4).

peratures. Studies published in February, 2020 in the journal *Nature* show that fossil fuels are a far greater methane source than previously realized. Some scientists believe that  $\text{CH}_4$  emissions from fossil fuel production have been underestimated by 25 to 40%.

That may change under the Biden Administration. Biden has expressed interest in new technology that can identify GHG emissions from space. The "superemitter sites" reported on by the *New York Times* can now be easily identified and forced to shut down.

It's still worth reducing emissions from cattle, to buy time for other things we need to do. Debate simmers about whether grass-fed animals emit more GHGs than feedlot animals, simply because they fatten slower and live longer lives, or whether cattle managed on pastures are a net positive given their ability to build carbon back into the soil. Meanwhile, progress is being made on reducing  $\text{CH}_4$  emissions from cattle.

Some center on a seaweed, *Asparagopsis taxiformis*. Trials at University of California (UC) Davis have shown that just a sprinkle in feed can reduce a cow's emissions 30-90%. Mars and Land O' Lakes are investing in a project with Blue Ocean Barns, which plans to have a product available in California (where reductions in herd methane emissions are mandated by law) in late 2021. Another company, Symbrosia, is trialing a seaweed product at Z Farms in Dover Plains, NY.

AllTech has a yeast culture product available, which doesn't reduce methane

production per se, but increases milk production, thus reducing GHGs per unit of milk. Mootral, a Swiss company, puts out a garlic and citric acid product being studied by UC Davis which inhibits methane production by about 23%—significantly less than seaweed, but with the advantage of having an existing supply chain. There's also an essential oil product which results in an 8.8 to 20% reduction per kg of milk.

Another approach under serious study is feeding biochar to livestock. Studies show that adding 1% or less of biochar per unit of feed could reduce  $\text{CH}_4$  emissions by 10-18%. This has an added benefit of sequestering soil carbon and improving soil health. One Australian farmer who fed his cattle biochar and allowed them to spread it in their manure found it produced "a quantum leap" in the fertility of his farmland. Dung beetles and other soil organisms transport the char underground, where it can sequester carbon for centuries, while vastly increasing the productivity of the land. Biochar typically needs to be inoculated by being mixed with manure, urine, or compost before being spread. Using livestock to feed it through accomplishes the job all in one go, so to speak. It also can improve animal health. Many of us have taken charcoal tablets or fed them to our dogs to deal with an excess of digestive gases. This benefit extends on the global scale.

Jessie Haas is the author of 41 books, most recently, *The Hungry Place*. She lives in a 450-s.f. off-grid cabin in Westminster West, Vermont for the past 36 years.

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RESOURCES

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

To join this group go to: <http://350vermont.org>

**American Council for an Energy-Efficient Economy: [aceee.org](http://aceee.org)**

**American Solar Energy Society (ASES): [www.ases.org](http://www.ases.org)**

**Backwoods Solar:** Specialty: solar, off-grid - [www.backwoodssolar.com](http://www.backwoodssolar.com)

**Carbon Tax: [carbontax.org](http://carbontax.org)**

**Clean Energy NH: [www.cleanenergynh.org/](http://www.cleanenergynh.org/)**

**CO2.Earth:** See emissions harms, scientific advice, and pathways to follow. [www.co2.earth](http://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](http://publicservice.VT.gov/energy/ee_cleanenergyfund.html)**

**Dsireusa.com:** Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency. [www.dsireusa.com](http://www.dsireusa.com)

**Efficiency VT:** A must-go-to site for immeasurable amounts of info. [www.efficiencyvermont.com](http://www.efficiencyvermont.com)

**Energy Efficiency & Renewable Energy Clearinghouse (EREC): [eetd.lbl.gov](http://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](http://www.energyguide.com)

**Energy Star Federal Tax Credits: [www.energystar.gov/about/federal\\_tax\\_credits](http://www.energystar.gov/about/federal_tax_credits).**

**Federal Energy Regulatory Commission (FERC): [www.ferc.gov](http://www.ferc.gov)**

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

To join this group go to: [groups.google.com/group/fossil-fuel-freedom-](https://groups.google.com/group/fossil-fuel-freedom-)

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

A lot of great information! - [hes.lbl.gov](http://hes.lbl.gov)

**IREC/ Interstate Renewable Energy Council:** RE educational info. [www.irecusa.org](http://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](http://www.nabcep.org)

**NESEA/ Northeast Sustainable Energy Assoc.: [www.nesea.org](http://www.nesea.org)**

**National Association of Energy Service Co. (NAESCO): [www.naesco.org](http://www.naesco.org)**

**National Renewable Energy Laboratory (NREL): [www.nrel.gov](http://www.nrel.gov)**

**NeighborWorks® Alliance of Vermont:** Low-cost energy loans - [www.vthomeownership.org](http://www.vthomeownership.org)

**New York Solar Energy Industries Association/NYSEIA [www.nyseia.org](http://www.nyseia.org)**

**New York Solar Energy Society (NYSES): [www. nyses.org](http://www.nyses.org)**

**NFRC** independent rating & labeling system for the windows, doors, skylights [www.nfrc.org/](http://www.nfrc.org/)

**NH Energy Divison: [www.nh.gov/osi/energy/index.htm](http://www.nh.gov/osi/energy/index.htm)**

**Renewable Energy World: [www.renewableenergyworld.com](http://www.renewableenergyworld.com)**

**Renewable Energy Vermont: [www.revermont.org](http://www.revermont.org)**

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

**SmartPower: [www.smartpower.org](http://www.smartpower.org)**

**Solar Components: [www.solar-components.com](http://www.solar-components.com)**

**Solar Jobs:** Listed by city, state, and district, [SolarStates.org](http://SolarStates.org)

**Solar Power Rocks:** Impressive data and info ,including per state. [www.solarpowerrocks.com/](http://www.solarpowerrocks.com/)

**Solar Store of Greenfield, MA** Stock & install a wide variety of solar & environmentally friendly technologies. [SolarStoreofGreenfield.com](http://SolarStoreofGreenfield.com)

**Tax Incentives Assistance Project (TIAP): [www.energytaxincentives.org](http://www.energytaxincentives.org)**

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

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

**VPIRG:** understand the clean energy resources available to VT - [www.vpirg.org/cleanenergyguide](http://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](http://www.veic.org)

**Weatherization, Energy Star & Refrigerator Guide: [www.waptac.org](http://www.waptac.org)**

*Energy Plan: Electrifying Needs*  
*Cont'd from p.6*

to fix." Does it really? The new lending is all about energy efficiency. If you fix your leaky building, you will pay less for heating and cooling. You can pay the loan off with savings. Wall Street loves this formula.

What to do? Electrify. Electric motors, induction stoves and electric heating and cooling curtail gas usage. Have you seen those funny white boxes with a fan inside? They are finally appearing on New York rooftops, terraces, side yards and can be hung on a bracket alongside your apartment. We call these 'air source' or 'heat pumps'. The heat or air conditioner actually comes from warm molecules captured from the air. The pipe into your home takes up a two-inch hole instead of a whole window.

It's the same with electric cars. Does extracting oil, making gasoline, delivering gasoline to thousands of gas stations, burning gas in an inefficient engine and discharging heat and polluted air still make sense? Why drive around and around the block looking for a parking spot? We need quiet, no-service electric cars and convenient garage spaces where we can all charge equitably. ConEd is doing a four-year study of five different types of chargers to be located on the street in parking places. Why so long?

Loud, gas-powered mowers, blowers and trimmers smell horrible and pollute us with deadly particulate matter. Go electric and check out the interchangeable batteries that power multiple machines like snow blowers and lawn mowers. Forget the gas can. Electric motors are cheaper to operate.

Lastly, while other countries have built giant wind farms and mastered the technology to bring big wind onto shore, NYC builds more gas lines. We can get a new gas line from New Jersey to Greenwich Village. We can fill that pipeline with fracked gas which may have polluted someone's well water. What will power our future? Here in Riverdale, NY it will be clean energy and conservation.

*Wyldon King Fishman is president and founder of New York Solar Energy Society. [www.nyses.org](http://www.nyses.org).* ♻️

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# "There's Nothing Wrong With the Earth"

Jessie Haas

What if we really could have it all? Abundant, nourishing food for everyone, farmers able to make a good living while producing it, beautiful wildlands, a resurgence of threatened plants, bugs, birds, and animals, and a cooler planet?

Maybe we can. In fact, maybe we must. A growing consensus among environmental and climate scientists points to the crucial importance of restoring soil to its proper functions of supporting life while absorbing and holding global carbon stores. A study published in the journal *Nature* on October 14, 2020 (<http://bit.ly/Nature-10-14-20>), is just the latest example. Comissioned by the United Nations (UN) Convention on Biological Diversity, it provides a global guide to soaking up nearly half the CO2 added to the atmosphere since the Industrial Revolution and averting nearly three-quarters of the predicted animal and plant extinctions. How? By returning 30% of world farmlands to the wild. This would preserve and enhance the human food supply and stay within the timeline needed to meet the upper target of the Paris Agreement, a temperature rise of 2 degrees Celsius.

Too expensive? In fact, "(i)t's one of the most cost-effective ways of combatting climate change," according to Bernard B.N. Strassburg, a study author and scientist with Pontifical Catholic University of Rio de Janeiro and the International Institute for Sustainability. This most recent study calculated which swathes of which ecosystem would yield the most cost-effective returns for mitigating biodiversity loss and climate change.

A similar tool, The Global Safety Net, was released last month, identifying the most strategic 50% of the planet to



Communities dig terraces to stop soil erosion in Lushoto, Tanzania. Image: Georgina Smith/CIAT

protect. Other campaigns with similar aims include The Bonn Challenge and The Campaign for Nature. The UN Food and Agriculture Organization (FAO) has looked at the science and comes to the same conclusion. "We have lost the biological function of soil," says Barron J. Orr, lead scientist for the UN Convention to Combat Desertification. "We have got to reverse that. If we do it, we are turning the land into the big part of the solution for climate change."

Almost five billion acres of land around the globe has been degraded by agriculture, specifically tillage and deforestation. Returning a large fraction of that land to pasture or trees would convert enough carbon into biomass to stabilize CO2 emissions for 15 to 20 years, buying us time to convert to carbon-neutral technologies. FAO believes that it is doable with an investment of about \$300 billion. (To put that number in perspective, it's the amount the world spends on the military in 60 days.) It can be done quickly and with existing techniques and technology. In fact, we can all help.

What some call 'the pedosphere,' literally the ground beneath our feet, isn't just there

to cushion our footfalls from the 'lithosphere,' the rocks. It's an aggregate of minerals and microscopic life-forms that is an essential component of generating and sustaining life on earth. Soil and plants evolved together, cooling and oxygenating the planet as they did so.

Soil is the third largest carbon sink, one we've been emptying into the sky for the last several centuries. Since the dawn of agriculture, we humans have been reverse-terraforming the only planet we know can sustain us, ripping open the soil, exposing the stored carbon (aka humus) to sun, wind, and rain. We've washed soil into the ocean or flared it off into the sky, contributing to global warming. We've encroached deeper and deeper into the wild, endangering countless species that are of great value for themselves alone and may prove crucial to world ecosystems. (However little we remember it, each one of us lives embedded in an ecosystem, a web that produces oxygen, food, clean water, weather, shelter, and beauty for us and other living beings.)

Luckily the solutions are, according to permaculture designer Rhamis Kent, "embarrassingly simple and embarrassingly inexpensive." A new book by Vermonter Judith Schwartz, *The Reindeer Chronicles*, details several successful projects that illustrate this point. The most notable is the restoration of China's Loess Plateaus, recently an impoverished, degraded landscape that shed billions of tons of topsoil annually into the Yellow River. The Chinese government and the World Bank determined that restoring this land would cost less than continuing to deal with the damage and poverty endemic there. Through

controlling grazing, digging terraces, and planting trees, the brown dusty landscape was transformed. In an area where grandmothers once routinely starved themselves so their grandchildren could live, springs, streams, and birds have returned, farming is productive and profitable, and grandmothers live to enjoy their grandchildren's smiles. An area that was a cradle of Chinese civilization is now healthy again. And this transformation came at an astonishingly low cost of \$7 per acre.

Film-maker, John Liu, who chronicled this restoration, says in *Chronicles* (<http://bit.ly/Chelsea-Reindeer>), "This knowledge is a responsibility. Human beings are required to understand this, because this is the determination of whether we can become sustainable and...survive into future generation."

Liu also says, "There is nothing wrong with the earth." Nature is ready and eager to work with us. Life wants to live, seeds want to sprout, solar energy is everywhere. We can do more than we think. It's time to get started.

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

## GOLDEN BROOK ELEMENTARY SCHOOL – Cont'd from p.33

- Internet-based building management system to keep track of conditions, mechanicals, as well as efficiency and equipment needs
- Filtered ventilation
- LEDs, auto-lighting sensors and controls, and programmable outside lights
- Low-flow toilets, high-efficiency motors, insulation, and hot water recirculation programming, making the plumbing system highly efficient.



Functional classroom with views to the outdoors.

Banwell has previously demonstrated its efficiency and sustainability expertise with projects such as the Summer Park Residences multi-family housing building in Hanover ([bit.do/summer-park-res](http://bit.do/summer-park-res)). But municipal projects, such as schools, often have too-small budgets which severely limit the architects' ability to meet up-to-date standards, and building code requirements are far behind the times. So, insulation levels in the walls, roof and foundation are reduced, the windows are mediocre, the airtightness suffers. However, when forward-thinking wins out,

many districts choose to build LEED and Passive House schools (e.g., [bit.do/freeport-ph-hs](http://bit.do/freeport-ph-hs), [bit.do/portland-friends-ph](http://bit.do/portland-friends-ph)).

As Banwell President Ingrid Nichols said, "The school district chose not to follow the NECHPS ([bit.do/nechps](http://bit.do/nechps)) program but went through the checklist and added in as many energy-efficient features that the budget allowed. It is a good reminder when planning for schools to review higher initial up front cost features that have a quick payback, so that they are sure to implement all of the available high-performance features that they can. That way they can assure they

do not miss opportunities for efficiency and sustainability, [which would] save the taxpayers more than they would spend (in the near term)."

Our own elementary school upgrade here in Middlesex, VT was hamstrung by voter "frugality" from providing a safer, longer-lasting facility for our youngsters, which would have been cheaper to run and maintain. Sadly, voters chose to save a smaller amount up front by committing to larger long-term energy costs down the line, and without eliminating the ongoing fire hazards and exhaust fumes from fossil fuel heating and cooking equipment.

People commonly spend a lot on insurance in order to avoid big bills for health problems or house damage or a car crash in the uncertain future; or they spend a lot on college tuition with no immediate return; but they fail to apply the same principle to building efficiency even though those future costs are far from uncertain.

The award-winning, beautiful and functional Golden Brook School will serve its educational purposes very well. But, the extra costs to the environment and the taxpayers that result from the district's cost savings will be long term.

Barb and Greg Whitchurch are Board members of VTPH.org and have their own Passive House in Middlesex, VT ([bit.do/phc-vtbiz2](http://bit.do/phc-vtbiz2)). ♻️



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# EVs Gone Wild!

## Home-grown Electric Groomer Keeps the Trails in Shape at a Local X-C Ski Center

N.R. Mallery

"We have completed our electric groomer!" Eli Enman, the general manager at Sleepy Hollow Ski and Bike Center in Huntington, Vermont, excitedly announced. He hoped to have it done last winter but, sadly, told me it was not ready then. But now it is, and he continued, "It gets 10 to 15km of grooming range pulling our six-foot wide drag. Its base car is a 2015 Smart Fortwo electric vehicle. We put Mattracks on the back and Snocobra skis on the front. It's nice to groom trails with a radio and heat. Pretty cool!" Big congratulations from *Green Energy Times*.

This adds to the ever-growing sustainability at Sleepy Hollow Inn. We have published numerous articles in *Green Energy Times* because of their amazing achievements that make them one of the greenest cross-country ski centers in the state.

As more and more people like the Enmans realize, we must all continue to do even more to reduce our dependence on fossil fuels and get our CO2 levels down. Sleepy Hollow Ski and Bike Center continues to take this task to heart.

**Path to Sustainability.** Interestingly, it seems that their used (recycled) bookstore might have been the beginning of the Enman family's evolving path towards sustainability:

*Incorporating a 2015 Smart Fortwo electric vehicle in the design, this all-electric groomer gets 10-15km of grooming range pulling a six-foot wide drag at Sleepy Hollow Ski Center. Image courtesy of Eli Enman.*



- Their first taste of solar began in 2009 with an 8kW system from AllEarth Renewables' AllSun Trackers. An installation in 2012 of four Stiebel Eltron solar hot water panels produces 50% of their hot water needs.
- A grid-tied 23.7kW fixed panel solar array went online December 20, 2012. The 99 - 240W PV panels were installed by David and Eli Enman, with oversight by Peter Cassels-Brown of Green Mountain Renewables. They now

proudly boast an installed photovoltaic total of 32kW of clean, renewable energy from the sun! Designed to produce 100% of their electric needs at the inn, it should also be providing enough electricity to power the family's three houses on the property and even produce enough energy to power their snowmaking system.

- The snowmaking system was originally designed to cover 700 meters of trails with plans to increase the trail

system for up to 1.5 km. Snowmaking is being done with an all-electric design for the air compressors and water pumps that will run one SV10 HKD snowgun.

- Other sustainable practices at Sleepy Hollow Ski and Bike Center are:
- Ten loads of laundry per week are dried on wooden racks in the furnace room.
- Composting and recycling.
- Local foods for the Inn are purchased, organic when possible, and include local eggs. Maple syrup is produced on site.
- Last, but not least, the whole family drives hybrids with four Priuses adorned with studded snow tires to help negotiate the challenging half-mile driveway.

In 2013, Eli said that the Enman family's goal is to be 100% solar powered. They certainly have achieved lowering their carbon footprint. Watch their progress at [www.skisleepyhollow.com](http://www.skisleepyhollow.com). Better yet, get out and enjoy their trails and help to support their awesome efforts. We can all learn from their example. Call (802) 434-2283 to ask about COVID-safe requirements.

N.R. Mallery is the publisher of *Green Energy Times*. ☞

## XC Skiing: It's "HOT" Right Now – Cont'd from p.1

have them negotiating and enjoying mixed terrain safely, the technical nuances of the sport can be explored for years. XC skiing on the trails has two main disciplines, classic skiing and skate skiing, and within each there are sub-techniques that allow one to cover all grades of uphill, downhill, and flat terrain with efficiency and grace.

There is also off-trail skiing (for example, in a local park or on a snow-covered golf course) and backcountry skiing (up and down hillsides). And not to be discounted is the value of meeting and spending time with others who share the love of outdoor activity and nature. XC skiers are just really nice people.

XC skiing can be done almost anywhere snow coats the ground. There are also specific XC ski centers which feature mechanically groomed trails, ski equipment to purchase or rent, food and drink, and instruction. All the states that get snow in the winter have these ski centers (check out [www.XCSkiResorts.com](http://www.XCSkiResorts.com)), and it is well worth traveling to one to get started in the sport. In Vermont, check out the Craftsbury Outdoor Center, Sleepy Hollow Inn, or Stratton Mountain Nordic Center. In New Hampshire, check out Great Glen Trails which is a top sustainable center.

XC ski area operators are responding to the Covid-19 pandemic with widespread adoption of plans aimed at minimizing risk of virus transmission for staff and guests.



*Image from Fischer Skis, courtesy of Roger Lohr.*

For example, many XC ski areas have adopted e-commerce, and are requiring on-line purchase of trail passes, rental equipment, and lesson reservations. Plans to alter the flow of ski area traffic on the premises and in buildings for safe distancing, as well as limiting or eliminating indoor capacity, have also been put in place.

### High Demand

As per usual for the XC ski business, there is snow in some places and a lack of snow in others. But one thing is consistent, at least since August, XC ski gear has been flying off the shelves.

There are shortages for popular sizes of skis and boots. Bindings and ski poles are also hard to find. Manufacturers have been unable to supply enough products to fill the dealers' needs.

### Great Start

XC ski area operators across the region were upbeat about the demand and the level of business this winter, so far.

In Vermont, the Woodstock Nordic Cen-

ter, which traditionally relies on guests at the Woodstock Inn & Resort, has doubled sales of season passes with locals compared to other years despite a 50% decline in occupancy at the Inn. Woodstock manager Nick Mahood said, "We had our biggest day ever for revenue leading up to the holidays, and then there was a rain out. Then we got enough snow to open and increased business has occurred despite Vermont's restrictive travel policy". Mahood said that many local people who left the sport for years were coming back with their old gear that they want to get tuned-up.

On a recent visit I made to Green Woodlands in western New Hampshire (recently named a top place to XC ski in the U.S. by an on-line outdoor website), there was enough snow to ski, and there were only a couple of people not wearing masks. XC skiers appear to be respectful without being told to wear masks, and there seems to be a minimal chance to get infected with the virus when passing other skiers along a trail if you're wearing a mask. Now is the time to join in, get outdoors, and hit the XC ski trails!

Roger Lohr of Lebanon, NH, who owns and edits [XCSkiResorts.com](http://XCSkiResorts.com), has published articles and promotional topics on snow sports, sustainability, and trails in regional and national media. He is also the Recreational Editor for *Green Energy Times*. ☞

More on XC Skiing is continued on p.39



*Above: Three images of kids having fun cross-country skiing. Images from Fischer Sports and are courtesy of Roger Lohr.*



# XCSkiResorts.com



# Move Toward Zero Waste in 2021

Cassandra Hemenway

The phrase "Zero Waste" has been bandied about by gorgeous thirty-something Instagrammers long enough, so most of us have at least heard the term. It can seem like a nearly impossible goal, especially when the social media mavens hawking it have professional photo shoots of their not-quite-full-pint jar of yearly trash (while the rest of us do our best and still have to lug a thirty-gallon bag to the dump every couple of weeks).

I promise, I'm not going to suggest you reduce your trash to one mason jar per year. But I do have ideas for how to get started.

I can't name all of the good reasons to start down a zero-waste path, except my own. I am appalled at the volume and toxicity of waste that abounds in everyday living in the U.S. I take small steps in my personal life to change that, with the understanding that a full-spectrum soup-to-nuts approach is necessary and must start with product and package design. However, I believe the small actions of many people can influence and change larger systems. In this spirit, I invite you to try one or more of the tips below.

A good place to start is with the five Rs: Refuse, Reduce, Reuse, Recycle, and Rot, as advanced by Zero Waste lifestyle blogger and author Bea Johnson. This is just one way to structure your commitment to Zero Waste; another might be based on the old adage, "Use it up, wear it out, make do or do without."

**For today, I'll focus on the Five R's.**

**Refuse:** Every purchase is an opportunity to ask: Do I need it? Do I already have it? Can I get it second hand? If it will be a new purchase, can I afford a

higher quality item that will last? Can I live without it? "Refuse" is the most powerful of the Five R's.

**Refusal Tip:** When grocery shopping, favor produce without packaging. Most major grocery stores carry "naked" produce. Farmer's markets, CSAs and home gardening are all good ways to get produce without packaging as well.

**Reduce:** Reduction cuts across all aspects of our lives from clothing to household appliances, to food. The goal of reduction is to use or buy fewer materials, most of which ultimately end up as waste in one form or another. That may mean making do with what you have or buying one high-quality item that will last thirty years rather than a less-well-made version that may break or be obsolete in a few months.

**Reduce Tip:** Reduce food waste by planning meals, shopping only for what you need (even if it means foregoing that discount on buying six items or more), or learning recipes that incorporate all parts of the food, such as stems, peels, stale chips, or even cheese rinds. Use vegetable scraps and bones to make broth for soup bases or sauces.

**Reuse:** Reuse means getting the maximum life out of an object before consigning it to landfill or recycling. Buying secondhand is a great example of reuse. Reusing glass jars rather



er than recycling them is another example. Choosing reusable items over disposables significantly reduces landfilled waste.

**Reuse Tip:** Avoid single-use items by using reusable shopping and produce bags, coffee cups, water bottles and utensil kits. If you're already doing that, a good next step may be replacing paper napkins with cloth. Many of these items can be found at thrift stores, received from friends and neighbors who have excess (tap into your neighborhood listserv), or accumulated slowly over time.

**Recycle:** It's better to recycle than landfill, but recycling is only one part of the solution for sustainable waste reduction. Recycle after you have refused, reduced and reused. It's important to check with your local solid waste management entity to learn exactly what goes in your recycling bin.

**Recycling Tip:** Ask your local solid waste management team for a handout about what goes in and stays out of the blue bin.

**Rot:** After reducing food waste, feed what you can to animals or compost the rest. Depending on where you live, you may be able to compost in your backyard, but that's not the only way to "rot" food scraps. You may have a local food scrap curbside pickup service, or a convenient local drop off site. If not, post on your



## THE CHANGING FACE OF XC SKIING

Roger Lohr

Throughout the years, there have been some significant transformations in XC skiing to the benefit of skiers.

**XC Skis:** The most recent trend in XC skis is no wax skin skis, which is a return of the 1970s mohair strips embedded in the XC ski base. Most of the brands have integrated the concept with a synthetic blend of skin material strips to provide consistent grip in variable snow conditions. The advancement of "kick pockets" in ski construction has also been helpful and the combination of skins and ski construction allow a lightweight ski to work well on groomed trails or in ski tracks.

**XC Ski Boots:** Today's XC ski boots are much lighter and provide more support, comfort and warmth compared to boots of olden days. The support is supplied by sole stiffness, plastic upper cuffs, and straps while the warmth is incorporated with lightweight insulation products such as Thinsulate. There are XC ski boot model versions that accommodate a woman's foot with narrower heels, rounder toe boxes, and more curvature in the upper.

**Adjustable Ski Bindings:** The XC ski bindings are now adjustable while out on the trail with the ability for the skier to slide the binding forward or backward to adjust weight distribution. Move the binding forward to get better

grip or backward to provide more speed or better glide.

**PFOA Ban:** The international ski racing organization has limited or banned fluorocarbon compounds in ski wax due to health and environmental concerns. The waxes contained PFOAs or polyfluorinated materials that are linked to cancer, birth defects, hypertension and strokes in humans.

**Snowmaking:** There are more than 40 XC ski areas now employing snowmaking after deciding to invest in using machines to make snow. The availability of less expensive and portable snowmaking systems are main motivations to use snowmaking, but other business-driven issues are relevant too, such as filling lodge rooms, running programs, and fulfilling season pass holders' desire to extend the ski season beyond Mother Nature's whim.

**The XC Skiing Quiver of Gear:** There are distinct segments of XC skiing that take best advantage of different gear. Recreational or performance skiing on groomed trails at the XC ski area or resort allows a range of comfortable stability for those who want to avoid skiing out of control to responsive super lightweight speed sticks for the more athletic work out.

Ungroomed trails through the forest and downhill mountain slope descents

call for sturdier gear such as wider skis with steel edges and heavier boots and bindings. Narrow skin skis are great for the groomed trails at the XC ski area. Before purchasing equipment, it is best to consider what type of XC skiing you might prefer, or better yet, rent different types of gear, get a tour guide or instructor, and experience the different XC ski segments over time for yourself to help make this decision. ☺



Family skiing on Great Glen trails. Courtesy image from Great Glen Trails Outdoor Center.

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listserv to find out if any of your neighbors want extra materials. Gardeners love compost and may welcome your food scraps, so they get more compost for their vegetable beds.

**Rot Tip:** Contact your local solid waste management organization to learn local food scrap disposal options. You may be surprised how easy it is to separate food scraps and manage them as a valuable resource rather than as "garbage." Added benefit: your trash will no longer stink!

This is by no means a comprehensive guide to going Zero Waste, but if you try any or all of the tips above, please congratulate yourself. Moving toward a zero-waste lifestyle takes constant consideration and a willingness to slow down, rethink, and make small changes that accumulate over time.

Cassandra Hemenway is the outreach manager at the Central Vermont Solid Waste Management District. She writes and teaches zero-waste skills that include composting, recycling and finding alternatives to toxins in your home. She's an avid gardener and a big believer in small steps leading to big changes. ♻️

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