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FORD F-150 LIGHTNING

How to Get Yours ASAP!

Ford Motor Company

N. R. Mallery,
publisher of Green Energy Times

It looks like Ford is taking a bit of Tesla's thunder with their exciting new electric pickup truck. It is releasing the F-150 Lightning electric pickup truck at a price that is very competitive, and it has some super exciting new features. In our last issue of *Green Energy Times*, we had an article on electric and hybrid pickup trucks (www.bit.ly/GET-EV-pickups). We knew that something was coming, but we did not anticipate anything quite like this.

The response already has been extremely positive. In fact, Ford CEO, Jim Farley, announced that 44,500 reservations had been made in the 48 hours after the F-150 Lightning was revealed (www.bit.ly/F-150-reservation-count).

Joe Lorio said on autoblog.com, "The much-anticipated battery-powered 2022 Ford F-150 Lightning pickup has finally made its debut, a moment that feels like a sea change in the U.S. auto industry. The F-Series pickup has for years been America's bestselling passenger vehicle, and Ford's decision to offer it as an electric vehicle sends the message with a bullhorn. The EV's moment is upon us (http://bit.ly/Autoblog-F-150-moment)."

Jimmy Fallon, television host, is a F-150 owner. He has been talking about how much he wants the new F-150 Lightning (www.bit.ly/Ford-F-150-JF). In fact, on a recent late night TV segment, he was talking about all of their incredible statistics and excitedly said, "You can even power your home with it! I'm going to move in." He went

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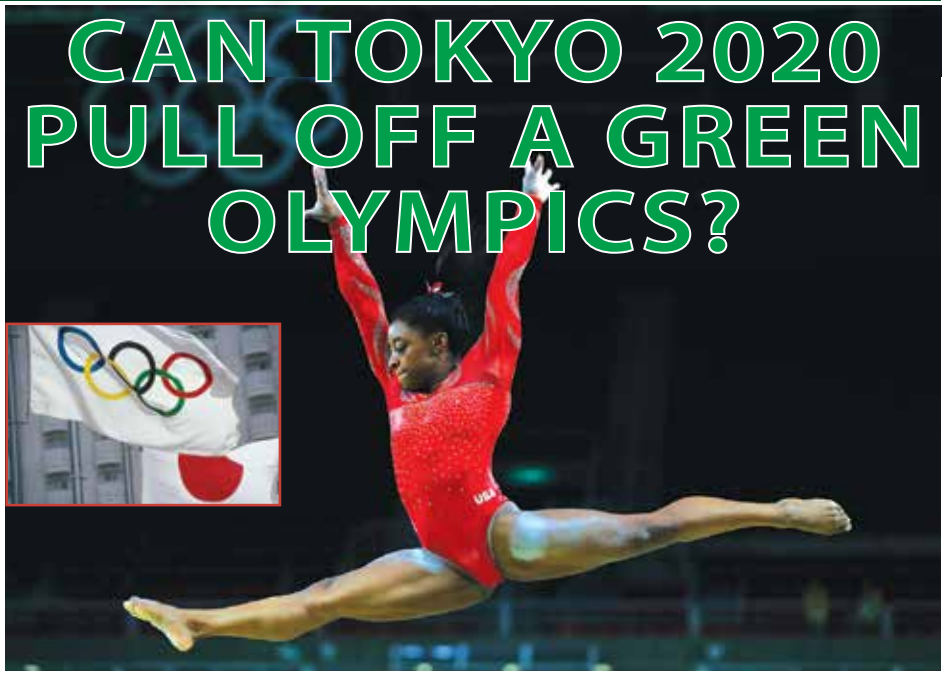
CAN TOKYO 2020 PULL OFF A GREEN OLYMPICS?



U.S. gymnast, Simone Biles performs at the 2016 summer Olympics in Rio de Janeiro, Brazil. Image: Fernando Frazão/Agência Brasil. Inset: The Olympic flag and the Japanese flag in Tokyo (IOC/Jean-Jacques Strahm)

Brett Yates

Edging out the FIFA World Cup, the Summer Olympics represents the world's most popular sporting event, with an international television viewership that, over the course of more than two weeks, encompasses about half of the human population. On the ground, however, residents of host cities aren't always so enthusiastic.

The Games of the XXXII Olympiad, scheduled to begin on July 23 in Tokyo after a one-year delay, have inspired unusual resistance on account of the Japanese public's fear of a coronavirus spike, but protest movements routinely trail Olympic bids, emphasizing associated problems such as residential displacement, increased policing and surveillance, ballooning public debt (amid corporate profit), and environmental degradation.

In 1992, the International Olympic Committee (IOC) began to incorporate environmental considerations into its candidature questionnaire, and since then, host cities have made plans to mitigate

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Keeping to 1.5°C – The U.S. Administration's Strategy for Dealing with Climate Change

George Harvey

In mid-May, the International Energy Agency released a report, "Net Zero by 2050," that warned that we must stop building coal-burning power plants worldwide and stop oil and gas exploration (www.bit.ly/Net-Zero-by-2050). Shortly after, on May 21, the G7 countries, U.S., Japan, Canada, U.K., Germany, France, and Italy, agreed to deliver climate targets that are in keeping with stopping global warming at 1.5°C. They are pushing for the other G20 countries to do the same (http://bit.ly/G7-agree).

We might review the events leading up to this.

On Earth Day, April 22, President Joe Biden introduced a virtual summit of world leaders on the climate crisis. Notably, all of the forty leaders considered most important attended. President Biden did not limit his comments to salutations, however. He increased the United States' greenhouse gas reductions from 25% by 2025 to at least 50% by 2030 (www.bit.ly/ghg-reduction-by-2030).

President Joe Biden opening the virtual summit of world leaders. (U.S. State Department. www.bit.ly/Biden-virtual-summit)

Actually, it is not hard to understand how the goal could be so dramatically increased. The political situation in the U.S. has changed a lot in the last few years. Today, not just a majority of Americans, but a majority of Republicans believe that climate change is a problem that needs to be addressed.

People don't need scientific instruments to see the change in the climate. They can see the increasing damage from droughts in the West, heat in the Midwest and South, storms on the Gulf and Atlantic coasts, and floods wherever the whim of Mother Nature decides.

But weather is not the only issue at play. We still have high unemployment because of the Covid-19 pandemic, and many people are having financial troubles. Addressing the climate crisis by installing new renewable power facilities will put many of these people back to work, and at good pay.

Relief is going to some who really need it. Under the previous administration, about

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Happy Anniversary Green Energy Times (2009-2021)

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

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

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

Solar Power works! … anywhere under the sun!

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

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

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G.E.T. NEWS!

A NEW COLUMN COMING IN *GREEN ENERGY TIMES*:

Stump the Chump

Do you have a recycling-related question?

Green Energy Times will have a column in the next issue to answer your recycling-related questions.

Please send your questions to michelle@greenenergytimes.org with "Stump the Chump" in the subject line. ♻

LETTERS TO THE EDITOR

Todd Walker's Praise – a Kudos to *G.E.T.*

"As both readers and an advertiser, we are increasingly impressed by the editorial evolution of *G.E.T.* It's grown from largely a systems hardware newspaper to now the undisputed clean energy lifestyle publication of New England and beyond – with tons of practical ideas for greener living. I just talked to a prospective client the other day and mentioned *G.E.T.* He immediately said it was his favorite publication."

— Todd Walker, Founder, Greenvest, socially responsible investment management

Orford Energy Committee

Hello Green Energy Times,

I serve on the Orford Energy Committee in Orford, NH. We're always looking for energy-related tips for our citizens and appreciate your permission to share G.E.T. articles via Orford's listserv. We find so many useful articles! Thanks so much!

— John Miller, Secretary, Orford Energy Committee

***Reply from* G.E.T.:**

We appreciate your asking permission to share our content.and are generally happy that you share helpful information with your group. It is appreciated if you are sure to give credits GET and include the link to the edition of our publication where the original article is still available. Thank you for all you and your group are doing there in Orford, NH.

— Nancy Rae Mallery, editor of Green Energy Times

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Examining VT's Response to Climate Change

Dan Quinlan

As part of Vermont's Global Warming Solutions Act in 2020, the state legislature created a Climate Council charged with analyzing the risks posed by climate change and developing a plan to build resilience to prepare the State's communities, infrastructure, and economy to adapt to the current and anticipated effects of climate change. Now that the new Council is up and running, and with the Federal government injecting new funding into the mix, a natural question for Vermonters is: what is the state's baseline with respect to current climate change and clean energy projects and programs?

A new report lays the groundwork for understanding what topics and challenges are being prioritized in the push to move Vermont toward a clean energy economy, limit carbon pollution, and prepare for the impacts of climate change that are unavoidable. Creating a view of activity underway is essential to any state government that is trying to develop a cohesive and comprehensive plan for moving to a clean energy economy and for addressing climate change. As state governments move forward on the opportunities and challenges in Vermont, it is imperative that they understand how they are spreading their resources. And, to make sure major opportunities and challenges are not being missed altogether.

During the summer of 2020, with support from the University of New Hampshire Sustainability Institute, the authors of the study compiled an inventory of Vermont's publicly funded programs. The resulting report, The Cost of Climate Change in Vermont: Part One – Spending Inventory establishes the foundation for a full analysis that would organize and document the spending that underpins the state's projects and programs. The arenas addressed include energy, transportation, food systems, land use and ecosystems, water management, public health, and economic vitality. The challenges and risks of climate change were categorized into three broad categories: reducing greenhouse gas (GHG) emissions, addressing climate risks (e.g., storms and flooding, rising temperature), and attention to the disproportionate risk to vulnerable communities.

Businessman investing in recycle innovation. (pixbox77/Adobe Stock image)

The study found that most of Vermont's programs address challenges pertaining to energy and transportation. Issues that have been more moderately addressed are in the arenas of food systems and land use. Findings from the report also indicate there is a clear need for increased attention to aspects of public health, water management, and the vulnerability of industries that will see a drastic impact by climate change. The report also points out the need to carefully analyze the level of effort and funding required to embrace the opportunities created by the move to a new energy economy, while also planning for climate change impacts that are no longer avoidable. Despite multiple attempts in Vermont to implement a comprehensive approach to these questions, the actions underway in state government remain an ad hoc patchwork of independent activities.

"This report has been an extremely helpful body of information as we build our latest Vermont Climate Assessment," said Gillian Galford, a UVM climate scientist leading the Vermont assessment project. "We're not aware of a similar study in any other state, and we expect to see this idea replicated across the country."

Given available resources and time, the team did not look at the spending supporting the more than 110 Vermont state programs identified in the report. A comprehensive view of existing spending is clearly needed, and would provide pivotal information to all the stakeholders – including the Climate Council, the Administration, policy makers, NGOs, and advocacy groups. "Understanding how we are maximizing our current expenditures to make our communities more energy independent and resilient in a warming world is a fundamental starting point. The analysis in this report will help Vermont identify what we can do better with existing revenues and, importantly, what else we must do — and why," said Johanna Miller, Energy & Climate Program Director at the Vermont Natural Resources Council. "And, with the new Global Warming Solutions Act requiring much greater, much needed pollution reduction, adaptation and resilience-creating progress, this report highlights where we are falling short and the significant transformation – and investments – required to help all Vermonters thrive in a rapidly changing world."

Copies of the report can be downloaded at www.solavida.org/state-climate-spending-analysis/.

Dan Quinlan is the founder of the Vermont-based non-profit SolaVida which developed the report. ♻

Fun, Free, and Safe

SolarFest '21 Focuses on Arts, Energy & Change

A second virtual SolarFest promises an exciting array of renowned speakers and performers on July 24th and 25th. As with the online festival last year, all the activities are free to the public.

"With all of the dynamic developments going on today in renewable energy, climate activism, sustainable buildings, and new government policies, it's urgent that we go forward fast and safely as we search for a new consensus for a sustainable world." says Bill Laberge, president of SolarFest.

SolarFest began in 1995 when a group from Middletown Springs, VT had an innovative idea to hold a music and arts festival powered by the sun. Since then, tens of thousands of people have enjoyed their unique blend of music, art, and education at a festival in Vermont that showcases the power and possibilities of solar energy.

To continue during Covid-19, longtime trustee and volunteer John Blittersdorf observed, "Last year, for our 25th anniversary, we had to pivot to a virtual festival, featuring multiple musicians and workshops, plus some outstanding speakers including Richard Heinberg, of the Carbon Institute, and Storm Cunningham on "Transition to a Regenerative Economy" in collaboration with the Center for Advanced Public Action (CAPA) at Bennington College."

While public gatherings are starting to be allowed, the planning and commitments for SolarFest began at the end of 2020. This year the virtual festival is focused on reaching new groups, restoring hope, and inspiring transformations in three key areas with meaningful and tangible paths forward: The Future of Energy Policy, Climate Justice and Environment, and Decarbonizing Buildings.

The second virtual SolarFest, on Saturday July 24th and Sunday July 25th, features insights into government policy direct from congressional and state leaders and the latest on the frontlines of activism from author and 350.org founder Bill McKibben, Oscar-nominated, Emmy winning filmmaker Josh Fox, and filmmaker for social and environmental justice Deia Schlosberg, director of The Story of Plastic. The full lineup includes musical performers and the top-flight, practical workshops that have made SolarFest the place for real change for over 25 years.

Complete festival information, including the latest events and time schedule, is available at www.SolarFest.org. Plus, the site includes videos from past year's keynote addresses as well as expert presentations on solar and storage systems, living off-grid, electric vehicles, regenerative food & agriculture, and more.

There's also big news for SolarFest as large public gatherings are restored. "Looking ahead," said Laberge, "we've been given a transformational donation that will allow SolarFest to establish a permanent home. The board is fortunate to have an experienced and dedicated group of volunteers working to identify the right site for SolarFest to put down roots."

Whether it's occurring virtually or in-person, SolarFest is New England's best place for a safe, family-friendly environment for fun, learning, and the most interesting conversations. ♻

How E-bikes Make Communities More Sustainable

Emily Wilson

VanMoof

So far, the speedy modernization of the transport industry has not benefited the environment. Sure, our love of travelling in speed, comfort and style has made things super convenient for us, but what about the planet, and what about our health? The sad truth is that our love of comfort and convenience has increased pollution and the dangerous impact of climate change.

However, the rise of electric bikes (or e-bikes for short) is flipping the script. Carl Benz first secured approval for the e-bike in 1886, but e-bikes as we know them have been around for about 20 years. Now they're more important than ever. The next steps towards a green and sustainable future will place e-bikes at the very center of change. Because they're fitted with an electric motor rather than a fuel tank and conventional engine, they're much better for the environment than most cars or motorbikes. Also, when they're charged using green energy like solar power, they can be 100% carbon-neutral.

The impact so far

E-bikes are already making our communities more sustainable. According to e-bike manufacturer VanMoof, their U.S. e-bike riders prevented 118.3 tons of carbon dioxide emissions from being released over the past year alone. Even better news, this is something that governments around the country have noticed. Los Angeles has built 1,190 miles of bike lanes, and Washington D.C. has built 48 miles of them. In New York City, the Brooklyn Bridge should soon be doubling the size of its bike lanes. It's a country-wide phenomenon.

The rise in bike lanes is also great news for financial sustainability. Protected bike lanes cost $20,000 to $100,000 per mile (car lanes cost $1 million) and their upkeep is also far less expensive. This makes cycling also a smart transport investment. And, while e-bikes themselves can be an investment, the federal government is already putting in the hours for an E-bike Act, which would provide a 30% tax credit for purchases. By reducing the amount we spend on car lanes and upkeep, we can increase community spending elsewhere. Just imagine the benefits!

In comparison to conventional vehicles, E-bikes are not only a more sustainable solution, they're a more convenient one, and their rise is leading to real governmental change in how our cities are built. If change is happening this quickly now, imagine where we might be in another 20 years.

The human benefit

Of course, a regular bicycle is a great option for sustainable travel. However, in communities where the terrain is hilly and the weather can get extremely hot, e-bikes are more attractive for people who are less used to cycling, people with disabilities, and those who are older or less agile. The built-in electric motor of the e-bike lets you travel farther, whatever shape you're in.

By putting confidence into the hearts of would-be bike riders, e-bikes can reduce our dependency on cars, ultimately reducing the number of car journeys we make, and lead to a greener world. In fact, customers said that reducing car trips was a key reason for buying an e-bike, according to a 2018 National Institute of Transportation and Communities survey of e-bike owners – and most U.S. car rides (76.8% according to the National Household Travel Survey) are under ten miles long. That's certainly a comfortable distance to cover on an e-bike.

And with all that exercise, it's obvious that e-bikes could make us healthier too. They've been proven to show an increase in physical activity, because they encourage people to take longer trips by bike. According to VanMoof, this is clear in the U.S. On average, American citizens travel 1.92 miles farther on e-bikes than people in the rest of the world and spend an average of 11.6 minutes longer on them.

Getting in this extra exercise, even adding ten minutes to the amount of physical activity you do in a week, can have massive health benefits! By riding an e-bike, you can improve your own health while securing a healthy future for our planet.

Riding into the sunset

So, whether it be providing encouragement to go out and exercise, supporting people with staying agile later in life, helping people with disabilities travel independently, or reducing the number of cars on the road, e-bikes could actively contribute to the quality of life for all of us.

And, of course, sustainable communities lead to a more sustainable planet. If we continue to reduce emissions by over 100 tons a year – as U.S. riders have proven is possible – we could actively tackle the climate crisis and leave the planet a far better and healthier place for future generations.

Emily Wilson works in editorial and is always looking for ways to support the environment in our cities.

Links available in online posting of this article on the Green Energy Times *website.* ♻

What NH Needs for Faster EV Adoption

Randy Bryan

Outside charging stations should be widely available. (https://alcse.org/)

I wish to revisit a topic discussed before, the profitability, or lack thereof, of electric vehicle charge station operators (EVSO). The issues are twofold: not enough plug-in vehicles (PEVs) on NH roads, and not enough fast charge stations.

We should strive for more PEVs. Assuming zero emission vehicles (ZEVs/EVs) are a good technology for NH (it is, see G.E.T.'s April-May 2021 issue on page 6), then we should encourage more ZEVs. Hence my recommendation is that NH join the New England ZEV Mandate Coalition. Without the ZEV Mandate, NH is left in short supply of EVs. We need cleaner air, and we want a growing economy. It just makes common economic sense.

The other major issue for more EV sales is not enough fast-charge stations. NH is behind our neighboring states in the number and distribution of fast-charge stations. Why buy an EV if you can't get it charged? But these stations are expensive and need funds from use, or upfront funds to make the investment affordable. There is a need for grant money to seed early fast- charge station sites. The Volkswagen Settlement money is available but not yet disbursed by NH. We hope this will be accomplished soon. This grant money has been offered two times recently, without any takers. Among the reasons is that it is difficult to make a profit in NH as a charge station operator. Early charge stations will be under-used (not enough EVs), until the station occupancy rises to a profitable level. Underused charging stations are a temporary problem, but a big stumbling block in the short term.

Why not just install a charging station and use it when needed? Legacy grid policies get in the way. Even though the average use of electricity by a new charge station may be low, charging sessions require high electricity flows (50-100kW now, headed toward 350kW, then 550kW, then 750kW by the end of the decade). Larger grid assets are needed to handle the anticipated high use, and this is expressed as a "demand charge" for commercial users. These demand charges put low use charge stations into the red quickly. At some level of use, demand charges break even with average use rates and the problem is solved.

A practical solution, implemented by several surrounding states, is to adopt a temporary deletion of demand charges and smooth them into the charging site electricity rates. Fortunately, the number of stations and electricity assets are low so the investment can be absorbed by the utility without much disruption. At some future point, the increased demand would need to be reassessed. But the first step is to adopt this practice, and NH and its grid operators should so consider.

The other idea needing support among grid operators is a 'make ready' program. Make ready programs are a commitment by the grid operator to provide grid feeds to an area close to the charge stations to minimize the buildout cost to the charge site operators. Since these assets will be used over a long period of time, they are beneficial to the grid operator as an investment in future growth and use of the grid.

To summarize: We need better enablement for EV owners to encourage faster uptake. Suggestions include the following.

1. Join the New England ZEV Mandate states to get an adequate supply of EVs.
2. Another idea is to offer a home charger-line rate for TOU (time of use, cheaper rates at night, more costly in day) to encourage EV owners to charge at night when existing grid assets are under used.

The other essential improvements are to enable the charge station operators to make money at low usage.

1. Offer the VW grant funds again for fast charge station buildout, soon.
2. Average demand charges into the charge site rate package for some period of years to enable lightly used charge equipment to exist until the demand builds.
3. Implement 'make ready' programs to reduce the charge station install cost at some public and private venues.

Thank you for your interest and consideration. Stay healthy and safe, and drive electric!

Level 2 EV charging stations at Fashion Centre at Pentagon City, Arlington, Virginia. (Wikimedia/Mariordo)

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

Electric Vehicles are Coming

Whether or Not Our Infrastructure is Ready

Joshua Singer

Changes are coming to our roads, highways, and rest stops, many that you may have already seen. Companies such as Tesla, Chargepoint and EVgo are installing electric vehicle (EV) chargers at rest stops and in cities and towns across the country. This is a first and necessary step towards electrifying our transportation system and is as needed as your local gas station for your internal combustion engine (ICE) vehicle. As consumers look for new cars, they are increasingly interested in EVs, but may be dissuaded due to "range anxiety," the worry that you won't be able to charge up when you need it, either on a long trip, or when out and about.

The Biden Administration has introduced new legislation that could address this lack of EV infrastructure. With his new Infrastructure Plan, the President is hoping to install 500,000 EV chargers across the country by 2030. This will include DC fast chargers that can charge a vehicle up to 80% of capacity in around ten minutes. In addition to this funding, there will also be new research funding for innovative technologies to reduce the cost of electric vehicle supply equipment for DC fast charging; funding for commercially available plug-in electric vehicles (PEVs) and funding for increased workplace charging availability.

A big hurdle to this plan is backing the chargers and increased electrical demand with the infrastructure to support it. Not only do we need to find space for the chargers and get them installed, but we need to have electricity supplies and distribution that can handle that increased load. This plays into the rest of the Biden infrastructure plan, electric transmission lines, energy infrastructure, and updating our old system to something that is more resilient, efficient and cost-effective.

This change is starting now, with companies such as Volkswagen, GM and Volvo making electric vehicle commitments over the next 10 years. The phase out of internal combustion engine (ICE) vehicles has begun. Many states are proposing new ICE vehicle bans or reductions; California by 2035, Washington State by 2030 and a potential ban of new sales in New York by 2030.

The Federal push for an EV fleet will spur massive growth of EV infrastructure, production and adoption. Large contracts with producers, and a broad rollout of chargers will ease early adopters' worries about vehicle range, and incentives will help people otherwise unable to transition to an EV to make that choice.

For more information about electric vehicles, charging infrastructure, and resources to help you figure out if an EV is right for you, visit http://www.driveelectricnh.org.

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

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

New Bus Station: Net-zero Electric with No Fossil Fuels

Bradford, Vermont

Barb and Greg Whitchurch

Vermont's mountainous, rural nature presents challenges to mass transit efforts. And private vehicle travel (especially in gas-mobiles) is costing us all a lot with its air pollution and climate effects. Thankfully, more and more people are depending upon bus transportation, and we're making great strides in meeting those needs.

Now, in addition to the inherent energy savings of bus travel as compared with personal vehicles, we are about to enjoy the energy efficiency of the bus station itself. The Upper Valley Community Transportation Center (UVCTC) is currently under construction and is located directly next to the existing Park and Ride at exit 16 on I-91 in Bradford, VT. It will provide bus storage, a bus wash, and office space.

V-shaped roof of the transportation center, designed for rain water collection. Buses enter from this side and the back. (Polly Wheeler, BRD). Rt: Roof water is funneled into this storage tank for use in washing the buses. (Greg Whitchurch)

The building will be net-zero electric, with no fossil fuel use. For now, the buses are still ICE (internal combustion engine) but will be replaced with EVs (electric vehicles), charging from the solar PV array. Heat will be provided by pellet boilers which heat an insulated radiant slab floor in the garage, which will be kept at a relatively low temperature in winter. (Low-Portland, high-ash concrete was investigated but failed to meet load targets, so they were forced to settle for standard concrete, which, along with steel, shares top-billing as the most environmentally costly building materials.) However, the large bus access doors will exceed code-required insulation levels.

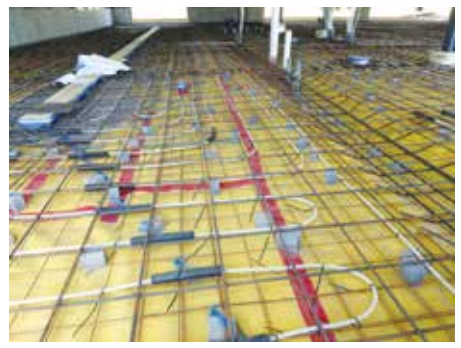
Daylight is provided in the garage by clerestory windows. The adjacent office will be heated by air-to-air heat pumps. The roof and ground-mounted solar panels (behind the building) will be installed by SunCommon. The solar array is sized to power the building and charge the buses in the near future, as Tri-Valley Transit (TVT TriValleyTransit.org/), the owner of this transportation center, anticipates the arrival of electric buses to their fleet within the next few years. EV chargers will also be provided for employees, while the adjacent Park & Ride already has its own EV chargers.

TVT is a non-profit which strives for energy efficiency throughout their operations. They provide bus service in Addison, Orange, and North Windsor Counties. The architectural firm is Black River Design (BRD) of Montpelier (BlackRiverDesign.com/). This is the second new facility that they have designed for TVT (the first was in 2011 in Middlebury, VT). The civil engineering work was done by Otter Creek Engineering of East Middlebury and Rutland, VT (http://ottercrk.com/). The Vermont Economic Development Authority (VEDA.org/) provided low-interest loans for this project, as they have for so many important advances in Vermont infrastructure improvements. (Groundbreaking and funding information is available at bit.do/bfd-bus.)

Another innovative aspect of the center is its bus wash. To reduce water consumption and site stormwater runoff, rainwater will be collected from the roof. The roofline forms a V-shape so that rain and snowmelt are directed toward a central depression, which itself is V-shaped from its ends toward a central drain. A buried 5,000-gallon tank stores the water. A similar system was installed at the Middlebury facility to supply its bus wash. As a result, the facility's water use will be similar to that of a single-family home!

Finish materials were selected for durability and low environmental impact. The floors (except bathrooms) are exposed concrete, and Insulated Metal Panels (IMPs) form the outside wall. The federal funding guarantees that the solar panels, pellet boilers and other elements will have been manufactured in the U.S.

We hope that this environmentally-conscious design and construction can influence the designs of other municipal and commercial buildings. And, just as importantly, we hope to have more electric vehicles parked inside them!



Insulated, heated floor in bus bays. (Greg Whitchurch)

Over the years, the Whitchurches have added solar PV and hot water to their own home and are slowly working on geothermal. They are owners of LEAF and Niro EVs and a net-zero Passive House in Middlesex, VT. www.LinkedIn.com/in/GregWhitchurch. ♻

Martha Vineyard's 50% Electric Bus Fleet

Electric Buses Get Solar Charging and Battery Backup On Martha's Vineyard

The Vineyard Transportation Authority (VTA) announced it will add four electric buses to its fleet, bringing the total to 16, or 50% of its fleet. But what is most newsworthy about the VTA electric bus program is that it will use electricity from solar panels to charge them. Read more at bit.ly/MV-EV-Buses-solar. ♻

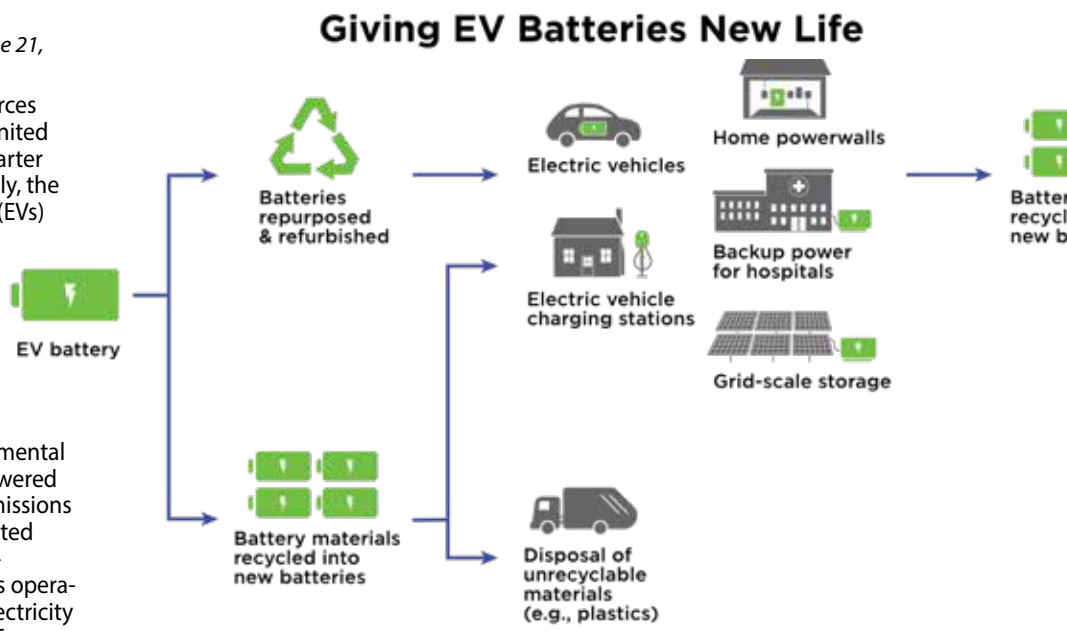
Buses charging under a solar canopy (Enel X)

Recycling Electric Vehicle Batteries

Jiayu Liang and Nick Iannaco
Reprinted with permission from Volume 21, Winter 2021 issue of Catalyst.

Vehicles are one of the largest sources of global warming pollution in the United States, accounting for nearly one-quarter of the country's emissions. Fortunately, the growing number of electric vehicles (EVs) is already helping to reduce emissions. Over their lifetime, EVs produce significantly less global warming emissions than vehicles with internal combustion engines, even with the prevalence of fossil fuel– generated electricity.

Where the majority of the environmental impact from gasoline- and diesel-powered engines comes from their tailpipe emissions while driving, most of an EV's associated global warming emissions occur "upstream"—that is, prior to the vehicle's operation, in its manufacture and in the electricity generated to power it. This means efforts to make EV technology even cleaner should target these stages in an EV's life cycle, by manufacturing batteries with recycled materials and adding more renewable energy to the power grid, which together can make a big difference in environmental impact over a vehicle's lifetime.



Giving EV batteries new life. When an EV reaches the end of its life in a new vehicle, it can be used for various "second life" purposes before being recycled into new batteries that power a new fleet of EVs.

Over the next 15 years, the number of EVs on US roads is expected to increase significantly, from roughly one million today to potentially tens of millions (depending on a number of factors). As demand increases for EVs, so will demand for batteries to power them—and to produce batteries in the necessary quantities, we must address many logistical, environmental, and ethical barriers.

Problems at the Source

Powering every electric vehicle is a linked group of hundreds, and sometimes thousands, of lithium-ion battery cells. Each relies on minerals extracted from reserves around the world, where mining can present a trove of ethical and environmental challenges. Lithium extraction, for example, can consume significant amounts of water. In the Democratic Republic of Congo, where the majority of the world's cobalt is produced, negative impacts on community health and human rights are well documented by Amnesty International and other organizations.

At the current rate of extraction, reserves of key minerals used in batteries could last up to 50 years, but as demand for EVs grows—a trend that will hopefully continue—so will the challenge of producing enough minerals to manufacture those batteries.

Fortunately, recycling offers the possibility of establishing a long-lasting and sustainable supply of critical battery materials. By extracting these materials from retired batteries, manufacturers can avoid the ethical and environmental impacts of mining for new materials, and meet up to 30% of total demand in the next 15 years. As the EV market grows, so will the supply of materials that can eventually be recycled, making it easier to sustainably meet battery demand as time goes on.

Cont'd on p.18

Ford F-150 Lightning

Cont'd from p.1

into detail about the 'frunk,' which is where a motor is normally. Instead, it uses this large space for storage.

Rachel Maddow, television news program host, also owns an F-150 (www.bit.ly/Ford-F-150-RM) and wants an F-150 Lightning. Even President Joe Biden is excited about it, as this video shows (www.bit.ly/Ford-F-150-JB).


Ford Motor Company

If some of the people closest to you aren't excited about this vehicle, they probably have not seen Ford's video announcing it, or the F-150 Lightning commercials. If you still haven't read all about the Lightning, you might want to see it for yourself (www.bit.ly/Ford-F-150-release).

The F-150 Lightning will come in four different trim levels:

1. The Basic model is priced at $39,974. It has a standard range of 230 miles and 426 hp.
2. The XLT starts at $52,974 before tax incentives.
3. The Lariat is another model that will be offered, though the price is yet to be announced.
4. The Platinum model, which starts at $90,474, has 563 hp and a 300-mile range.

How do you get one?

You can be one of the first to buy a new Lightning by reserving it on Ford's dedicated reservation site: www.bit.ly/Ford-F-150-reservations. An $100 deposit is required to reserve one, the same amount Tesla required to reserve a Cybertruck when their pickup was revealed. According to Ford, deliveries will start in the spring of 2022, so it will be a year-long wait before you can expect its delivery to you, if all goes as planned.

Some of the F-150 Lightning highlights:

- The F-150 Lightning comes with a dual-motor four-wheel drive with 775 pound-feet of torque. The standard-range model has 426 horsepower (hp), and the extended-range model has 563 hp.
- It is said to have the most torque of any F-150, and the 563 hp version can go from 0 to 60 in roughly 4.5 seconds, as quietly as one might imagine.
- The 4 x 4 SuperCrew four-door has a 5.5-foot bed.
- It can tow 7,000-10,000 pounds. A new Pro Trailer Hitch Assist automatically steers, brakes, and accelerates when hitching up a trailer.
- Ford is offering standard range and extended-range battery packs. The extended-range pack is included on the Platinum trim and optional on the others.
- Ford estimates 230 miles of range for the standard battery pack and 300 miles for the extended.
- The time to charge the battery depends on the type of charger and the size of the battery. The 32-amp mobile charger, which is standard for the standard battery, will charge from 15% to 100% in an estimated 14 hours. The 80-amp charger that comes with the extended range vehicle will add 30 miles of charge per hour, to bring the charge to 100% from 15% to 100% in 8 to 10 hours. With a Level 3 fast charger, the vehicle can be charged to 80% in 44 minutes or less (www.bit.ly/F-150-media).
- The F-150 Lightning is able to power an ordinary house for three days, before it has to be recharged. The basic truck has 2.4 kW of output available through eight 120-volt AC outlets in the cab, bed, and front trunk. Upper trim models can put out 9.6 kW of power, have two more 120-volt outlets and a 240-volt outlet in the bed. Ford claims that the 9.6-kW system, working through the 80-amp Ford Charge Station Pro and home-integration system, can supply an average house with power for three days during an outage. This is done automatically, with the system switching back to charging once grid power is restored.
- The base price is $39,974 before federal incentives of $7,500. Many states also may offer incentives.

When you are driving around in your new all-electric F-150 Lightning, you can also think of the great work you are doing saving the planet. Somehow, reconciling the ideas of being environmentally righteous with driving a hot pickup truck might eventually get easy.

As Bob Dylan sang, *"The times they are a-changing."* What interesting and changin' times we are living in! ♻


Ford Motor Company

A Small Business Community Solar Alliance

George Harvey

The latest word from Norwich Solar Technologies (NST) is about the Small Business Community Solar Alliance (SBCSA). The SBCSA membership is being offered to small businesses in areas of Vermont supplied with electricity by Green Mountain Power, as a way to reduce costs of electricity in a way that is about as easy as we might imagine possible. One point NST makes is that the SBCSA was designed specifically for small businesses, and it was designed by people who know what that means, because they are a small business.

There are other reasons besides expenses to join the SBCSA, and these are important, so we might best review them right at the start. One, which just about any reader of Green Energy Times already knows, is that we really need to address climate change. Because this has been put off far too long, it has become very important that we do it we a careful view to sustainability. We need to stop burning fossil fuels, but we also need to include a plan for resilience in our thinking.

Also, businesses in Vermont need to address the question of not only how our electricity is generated, but where it is generated. Every year, we export many hundreds of millions of dollars to buy energy that is imported. Some of this is electricity, but most of it is in various types of fuel, gasoline, diesel oil, propane, and natural gas. We need not only to switch to electricity, we need to develop local resources to avoid continuing the ongoing drain of money our economy has been experiencing for many years.

A store business partner in the Small Business Community Solar Alliance. (Norwich Solar)

NST is building solar arrays in Vermont, and businesses can sign up through the SBCSA to get their electricity from those arrays. Creating more renewable energy in our state makes Vermont stronger and more resilient, and means less of our dollars are exported out of the local economy. There are a whole host of local suppliers and contractors that are employed in the construction of each solar project, which also results in a stronger local economy. The SBCSA program helps address both the climate issue and the local economic issue. It keeps money in the state, and it employs local workers.

A business can join the SBCSA without cost and without being encumbered by an annual contract. There is no need to be overly concerned about the installation of solar panels or where they will go. NST handles the necessary paperwork and keeps track of solar credits in a way that is transparent and predictable. The small business will still pay a bill from GMP, along with a bill from NST, but the two together will cost about 8% less than the old GMP bill did. So, for the inconvenience of paying one more bill, you get 8% off the total payment. Also, calculations of the cost for solar credits, which are paid to NST, are based on annualized data, so that part of your bill is absolutely predictable.

Apart from saving the planet and fostering the economy and people of Vermont, any business that is a member of the SBCSA has other benefits. One of these is digital access to projects to be able to track how they are doing. Another is marketing benefits. Member businesses can post supplied signs and take advantage of press releases identifying them as among those working to save the planet and promote the local economy.

In its documentation, NST said, "Undertaking serious sustainability initiatives is imperative for concerned business owners seeking to reverse the trend of our rapidly warming climate. By joining the Small Business Community Solar Alliance, your organization is making a highly visible demonstration of its commitment to the fight against global climate change and supporting the local economy."

Norwich Solar Technologies was founded in 2011. It has offices in White River Junction and Windsor, Vermont, and in Brunswick, Maine. Its projects have come to over 30 megawatts, saving customers over $20 million, and saving the planet from the effects of a million tons of carbon dioxide. Their website is norwichsolar.com. ♻

Bristol Community-owned Solar Expands

George Harvey

Acorn Renewable Energy Co-op of Middlebury, Vermont is developing a community-owned solar project in Bristol VT, and the funding is moving forward. The project, Bristol Community Solar (BCS), will require an investment of about $1,800,000. Acorn Energy is working with Aegis Renewable Energy of Waitsfield as its contractor on the project.

Solar site layout for the Bristol Community Solar Array, a 500-kW solar project located in Bristol, Vermont. (Aegis Renewable Energy)

BCS will have 1,694 solar panels, each of 440 watts. They are bi-facial, so they can generate power from light that is reflected from snow behind them. BCS will be built on over three acres of the capped former municipal landfill off Pine Street in Bristol. The maximum output of the array will be 500 kilowatts of AC power.

The Bristol landfill is ideal for solar development since it has good solar exposure from the south and cannot be seen from public streets and nearby homes. Since it is on a "brownfield" site, it received favorable treatment from Vermont's energy permitting and approval agencies. Acorn Energy Co-op was issued a Certificate of Public Good for the project by the Public Utility Commission April 1, 2021.

"If we are successful, we will have local investment, ownership, and management of a solar array developed in cooperation with the host community, and we will have made the most of a brownfields redevelopment opportunity as well. There are multiple winners all around," said Acorn Energy Co-op President Benjamin Marks. "We hope that the installed price per watt of the array will also be attractive for prospective participants."

The Acorn Energy Co-op's innovative investment model calls for two initial categories of investors in Bristol Community Solar. It is to have a single Series A Member, and multiple Series B Members. The Co-operative Insurance Companies of Middlebury will be the Series A investor and will provide about a third of the capital needed to the project. In return, it will receive federal tax credits. Their involvement helps to keep the costs down for the Series B investors.

"We are extremely pleased to have Co-operative Insurance as a major participant in Bristol Community Solar," said Richard Carpenter, Acorn Energy Co-op's treasurer. "They played a similar major investment role in our Shoreham, Vermont project, Acorn Energy Solar 2, as well as our Middlebury project, Acorn Energy Solar One."

An Investor in Series B Membership must be qualified as a Vermont resident or organization, have an electric meter in the Green Mountain Power (GMP) service territory, and be (or become) a member of the Acorn Energy Co-op. The investors will receive the project's net-metered credits on their GMP bills, and ultimately take ownership of the project.

Participation in BCS was originally very restricted, but it has been expanded to any Vermont resident who has a GMP electric meter, regardless of where they live. We should point out that renters are allowed to invest in the array, if they have GMP accounts, and their ownership can continue if they move to another location with a GMP meter.

The minimum investment in BCS will cover five units of the array. Each Series B Unit corresponds to a 405-watt section of the array and is priced at $702. The minimum investment is five units or $3,510.

Six years after the Bristol project begins electricity production, the equity structure will change so the individual investors may take full ownership of the project, making BCS one of a small number of true community-owned net-metered solar projects in the state.

"Acorn Energy Co-op is very excited to be moving ahead with this community-owned solar project developed by Vermonters for Vermont residents," says president Marks. "We believe it will help decentralize the grid, and will also help the State of Vermont to reach its ambitious goal of 90 percent renewables by 2050."

Organized in 2008, The Acorn Energy Co-op is a member-owned cooperative serving residents and businesses in Addison, Rutland and Chittenden counties. The Co-op provides education, outreach, products and services, as well as community solar projects that help members make the transition from our present reliance on fossil fuels to greater use of renewables and local solutions.

A schedule of informational online meetings for prospective investors can be found at acornenergycoop.com. For more information on Bristol Community Solar, or to join the Acorn Energy Co-op, visit that site. Email for the Co-op is: info@acornenergycoop.com, or call Mary Mester at 802-385-1911. ♻

Power Guru Launches Community Solar for Bennington

George Harvey

Power Guru is working on a project in Bennington, Vermont that's worth getting excited about. The long-awaited Vermont Mill Properties Community Solar Project, with actual installation set to begin this June, coincides with the anniversary edition of *Green Energy Times*.

Development work for the Vermont Mill Properties Solar Project began three years ago and as anyone who follows 100+kW projects with multiple subscribers and owners quickly learns, there can be a long time between starting development and actually arriving at the site with equipment and tools. Now, after the preliminary work has been completed, development is entering its final phase.

Vermont Mill Properties Community Solar will host a 150-kilowatt array that will produce nearly 200,000 kWhs in the first year. As a community solar project, the energy production is offered to all commercial, residential, and rental Green Mountain Power customers. Since GMP provides roughly three quarters of all of the electricity sold in Vermont, there are a lot of people who qualify to subscribe. Any GMP customer wishing to learn more, receive a quote, and subscribe should reach out directly to Power Guru.

Community solar offers the least carbon footprint option to power off of clean energy. Residential and commercial GMP customers who either cannot or do not wish to install solar on their properties make for great subscribers to a project like the Vermont Community Solar Project. One example of a ratepayer who can benefit from a community solar subscription is a tenant with a GMP account. Having no physical place to install the solar, a tenant can still get the benefit of having a solar system with a community solar subscription. However, for a large number of GMP customers, just knowing that their carbon footprint is as low as possible is enough reason to invest, and the other advantages of a locked-in low rate with GMP and a $.03/adder per kW are secondary.

The interest from potential subscribers at the Vermont Mill Properties has been significant enough that Power Guru is in development of a second array, Shadowbrook Farm. This array will be offered for business subscribers who wish to reduce their carbon emissions and save on energy costs.

The Vermont Mill Properties' mill building is quite old and has a long history dating back to the end of the Civil War in 1865. Since it was built just as that war was ending, at the beginning of declining business, its builder lost money on it. The mill had a rather checkered history after that, with one rather long period of successful business operation. At one point, it had 800 workers, but it fell into disuse in 1938. In 1988 Jon Goodrich and Mace Company bought it, and it began a new and more profitable period. Goodrich recorded a brief video on the property that can be seen at www.bit.ly/VT-mill-history.

We are very pleased to note the following quote that came to us from Karen Jernigan, Vice President of Sales and Marketing at Power Guru: "Power Guru would like to say thank you to the *Green Energy Times* for supporting our business through years. Thank you for sharing pertinent industry news that educates and encourages clean energy support, investment, and participation. As we continue to grow and expand our operations in Vermont, New York and Massachusetts, we look forward to reading and sharing our work with *Green Energy Times* readers."

Please direct all inquiries to info@power-guru.com to learn more, www.power-guru.com. ♻

Vermont Mill Properties' Community Solar will host a 150-kilowatt array that will produce nearly 200,000kWhs in the first year. (Courtesy image)

As a community solar project, the energy production is offered to all commercial, residential, and rental Green Mountain Power customers.

Many thanks to our sponsor

Moultonborough, NH 2-MW Solar Just Keeps Getting Better

The NHEC Project Now Includes a 2.45 MW Battery for Storage

George Harvey

The 2.45 MW battery storage at the site of NHEC's 2 MW Moultonborough Solar Array in New Hampshire (Courtesy images from New Hampshire Electric Co-op)

Last November, *Green Energy Times* published "Big, Bigger, Hugest," an article about the Moultonborough Solar Array (MSA) (www.bit.ly/GET-Hugest). That array, which belongs to the New Hampshire Electric Cooperative (NHEC) was the largest in New Hampshire, at 2 megawatts (MW).

Now, NHEC has given us an update on the MSA. NHEC has partnered with ENGIE North America (ENGIE) to install a 2.45-MW battery at the MSA site. The battery will be owned and operated by ENGIE, but through an innovative agreement, NHEC will be able to discharge it up to seventy times per year.

There is an obvious advantage to the utility to buy electricity when demand and prices are low, store it in a battery, and sell it when demand and prices are high. However, here is more to the economics of battery storage than that.

Transmission charges are set periodically by the independent system operator, ISO New England, partly based on the greatest amount of electricity transmitted at any time. The greater that amount is, the higher all the transmission costs are. This means that if batteries can be used to reduce the greatest transmission loads, the cost is reduced for all electricity that goes through ISO New England's lines for the entire year. NHEC estimates that the battery in Moultonborough will save its customers $2.3 million over the next twelve years.

The battery will also give NHEC important experience with energy storage, which is one of the fastest growing technologies in the field. Steve Camerino, President and CEO of NHEC, said, "Energy storage is a rapidly evolving technology that has a key place in our strategic vision for our business model of the future. It's important for NHEC to gain firsthand experience with batteries so we can better understand the benefits they have to offer our members and the operation of our system."

Laura Beane, Chief Renewables Officer of ENGIE North America, made another important point: "The addition of battery storage systems such as these are not only delivering real value to customers today, but also helping to accelerate the energy transition. NHEC's leadership in commissioning this project reflects their commitment to innovation in supporting cost effective, clean energy for their members."

The combination of batteries and renewable energy is not just saving customers money, it is helping us go through the transition away from use of fossil fuels to reduce our greenhouse gas emissions.

MSA is the first grid-scale battery owned by NHEC. It is also the largest battery in New Hampshire. We can expect that more and larger batteries will come to New Hampshire as the transition to renewable energy continues.

The New Hampshire Electric Cooperative is a member-owned electric distribution cooperative headquartered in Plymouth, NH. They serve 85,000 homes and businesses in 118 New Hampshire communities maintaining and servicing 6,000 miles of energized line. Learn more at NHEC.com.

ENGIE North America Inc., part of the French multinational ENGIE Group, helps customers decarbonize, decentralize, and digitalize their operations more efficiently and optimize energy and other resource use and expense. Nearly 100% of the company's power generation portfolio is low carbon or renewable. Learn more at engie-na.com and engie.com. ♻

New Hampshire's largest solar array to date: Moultenborough's 2 MW array solar site. (NHEC)

Pollinator-friendly Community Solar

IN THE NEW YORK CAPITAL REGION

Sophy Fearnley-Whittingstall

As chilly winds and snow give way to warmer temperatures and unfurling leaves, the air feels charged with hope and optimism. Like many businesses across the United States, Eden Renewables has had to find new ways of working and meeting unprecedented challenges. As the country starts to unlock, this summer ten new community solar farms developed by Eden will break ground in the New York Capital Region, an exciting next phase for the solar development company.

These solar farms will deliver clean, solar power to households in the towns of Claverack, Duanesburg, Glen, Schaghticoke, and Schodack allowing subscribers to save 10% on their electricity bills. But although providing clean, low-cost community power is important, they will bring much more to those places.

Eden is a pioneer in developing pollinator-friendly solar farms; instead of leaving the ground bare beneath the solar arrays, or with a grass monoculture, it is used in a positive way to encourage better biodiversity and ecology.

Many will already be aware that the world faces both a climate and an ecological crisis. The changing climate and lack of healthy food sources for wildlife are interlinked. But there's an economic case to answer as well as an environmental one. Pollinators such as honey bees and native bees play a vital role in U.S. agriculture, providing more than $15 billion of value in pollination services every year. Our farmers depend on these beneficial insects to produce many food crops.

Eden's solar projects specifically benefit pollinators by sowing a mixture of native wildflowers, sedges and grasses as ground cover at every site. Each solar farm is about 30 acres and in total, more than 35 million new pollinator-friendly flowering plants and native grasses will be thriving under and around the panels. At many sites, new trees and hedgerows will be planted, which have the dual purpose of helping to screen the solar arrays from public view as well as providing valuable shelter and habitat for wildlife and connectivity for foraging. Bird and bat boxes are provided on the perimeters.

Eden also works closely with local farmers to maximize the agricultural benefits of the projects, and you will often find sheep grazing among the panels as part of the land maintenance program, as well as beehives to produce honey.

Eden's ecologist Brian Kirkpatrick surveying invertebrates at one of our Capital Region solar sites; rt: Pollination in action at one of Eden's UK solar sites. (Photos: Eden Renewables)

The company's work to develop pollinator-friendly solar farms in the U.S. originates from its team's experience of over 10 years at the forefront of the solar industry in the UK and is backed by extensive research. Biodiversity scorecards are used to measure the performance of each project and monitor progress with annual ecological surveys. This annual research consistently shows an increase in abundance of wildflowers and grasses, with corresponding growth in numbers and varieties of bees, butterflies and birds.

At one solar farm in the South of England, the land has been managed to encourage wild grassland breeding birds, resulting in two sightings of a rare, endangered bird species, the Cirl Bunting, which is only found in a very small area in the UK. A 40-fold increase in butterflies was also observed!

While generating solar power has obvious direct carbon reduction benefits to tackle the climate emergency, programs are also implemented to measure the increased carbon sequestration from leaving the land around the panels to be largely reclaimed by nature.

The Eden team's work on maximizing biodiversity at solar farms in the UK initially spread to Minnesota, informing the work of U.S. stakeholders and scientists, resulting in the state's legislators unanimously adopting the nation's first standard for pollinator-friendly solar in 2016. That reached many more U.S. states and was adopted into law in both Vermont and New York in 2018 with the Pollinator-Friendly Solar Act.

Eden's first three community solar farms in New York's Capital Region were consented in 2019, but construction was delayed due to the pandemic. Nevertheless, during 2020, seven additional projects in New York were approved. By this time in 2022 there should be butterflies fluttering, birds singing and honey bees buzzing around newly planted photovoltaic panels. The future looks bright for pollinators and solar in the Capital Region!

Sophy Fearnley-Whittingstall is responsible for community engagement at Eden Renewables. To find out more visit www.edenrenewables.com. ♻

FEDERAL

FEDERAL INVESTMENT TAX CREDIT

• The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 26% of expenditures through 2022. For commercial geothermal generating systems, microturbines, and combined heat and power the ITC is 10% of expenditures.

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

• Biomass heating systems Tax Credit: 26% of the purchase and installation costs (with no cap or lifetime limit) for tax years 2021 and 2022; reduces to 22% of purchase and installation costs in 2023 (under Sec. 25D of the U.S. tax code)

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

USDA RURAL DEVELOPMENT PROGRAM

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

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

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

BIOREFINERY ASSISTANCE PROGRAM

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

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

• Increase energy independence

• Promote resource conservation, public health, and the environment

• Diversify markets for agricultural, forestry products and agricultural waste materials

• Create jobs and enhance economic development in rural America

• For more information go to www.rurdev.usda.gov/BCP_Biorefinery

REGIONAL

NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

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

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

• have an annual budget up to $100,000

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

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

VERMONT

CLEAN ENERGY DEVELOPMENT FUND

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

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

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

• Residential Bulk Pellet Bins. Up to $3,000 rebate.

• Coal Change-out adder. Up to $7,000 additional incentive for a pellet heating system if replacing a coal heating system. Businesses can get up to an additional $27,000 incentive.

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

• **More into at at fpr.vermont.gov/ woodenergy/rebates**

• **Windham County**

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

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

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

Other Utilities Heating Offers

• Members of Washington Electric Co-op (WEC) can get a $1000 rebate on approved pellet boilers and $500 for pellet furnaces. This can be combined with the CEDF and Efficiency Vermont incentives for a total of $7000; $250 for qualifying pellet or wood stove installed by a qualified installer. This can be added to stove offers from CEDF and Efficiency Vermont.

• Members of the Vermont Electric Co-op can get a $150 credit on the purchase of an approved pellet stove: www.vec/energy-programs.

• Stowe Electric Customers can get a $150 rebate with the purchase of a pellet stove.

VT TAX CREDITS

• Vermont offers an investment tax credit for installations of renewable energy equipment on business properties and wood and pellet heaters with at least 75% efficiency. The credit is equal to 24% of the "Vermont property portion" of the federal business energy tax credit from 2011 to 2016. For solar, small wind, and fuel cells this constitutes a 6.24% state-level credit for systems and for geothermal electric, microturbines, and combined heat and power systems, this constitutes a 2.4% state-level tax credit.

Tier III programs

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

EFFICIENCY VERMONT

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

Lighting

• Special pricing on select ENERGY STAR® LED fixtures at Vermont retailers.

• LEDs for indoor growing: $100 back for qualifying fixtures

Weatherization

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

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

Appliances (must be ENERGY STAR)

• Dehumidifiers: $25 - $40 rebate

• Clothes Dryers: $200-$400 rebate

Heating/Cooling/Water Heating

• Central wood pellet boilers and furnaces: $6,000 rebate (in partnership with CEDF)

• Advanced pellet or cord wood stove: $200 discount at participating retailers for replacing an old stove.

Heat Pumps:

• Air-to-Water System: $1,000/ton rebate

• Ducted Systems: $1000-$2000 discount at participating distributors

• Ductless Heating & Cooling System: $350-$450 discount at participating distributors

• Heat pump water heaters: $300-$600 discount at participating distributors;

• Moderate-income Vermonters are also eligible for bonus rebates up to $500 for heat pumps and heat pump water heaters.

• Window air conditioners: $100 for select ENERGY STAR Most Efficient models.

• Smart thermostats: up to $100 back for select ENERGY STAR models.

• Electric utility rebates may also be available.

Residential New Construction

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

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

Other Opportunities to Save

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

• Additional incentives may be available through your local electric utility provider,

contact your utility for more information.

Incentives for Pro-environment Agriculture Behaviors

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

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

Electric Lawn Mowers

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

• VEC (www.bit.ly/VT-mowers-VEC);

• WEC (www./bit.ly/VT-mowers-WEC);

• BED (www.bit.ly/VT-mowers-BED);

• VPPSA (www.bit.ly/VT-mowers-VPPSA);

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

• GMP (www.bit.ly/VT-mowers-GMP).

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSERDA

Welcome to the New York solar incentive and rebate information: 169 programs and incentives at: http://dsireusa.org (enter your zipcode) Programs and Services from NYSERDA: For the latest NYSERDA solar, ground source and air source heat pumps, EV residential and commercial incentives..

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

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

Extended Federal Tax Credits for Renewable Energy

Good news for renewable energy and climate action!

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

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

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

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

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

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

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

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

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

Commercial Solar Rebate Program

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

Incentive levels for PV systems are as follows:

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

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

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

Residential Solar/Wind Rebate Program

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

Residential Solar Water Heating Rebate Program

- Program is currently closed:

$1500 - $1900 per system based on annual system output

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

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

Residential Wood Pellet Boiler/Furnace

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

www.puc.nh.gov – Sustainable Energy or tel. 603-271-2431 for more information and current program status

LOCAL INCENTIVES

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

- *These are offered on a town-by-town basis.*
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes
- Information at www.nh.gov/osi/energy. for more information.
- Plug-In Hybrid Electric Vehicles (PHEV), and $300 on Electric Motorcycles.

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

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

NHEC offers incentives for Level 2 Electric Vehicle Charging Stations.

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

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

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

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

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

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

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

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

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

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

NH Home Performance with ENERGY STAR

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

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

NH ENERGY STAR Homes

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

NHSaves Residential ENERGY STAR ® certified Products Program

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

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

NHSAVES Online Store

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

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

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

NHSaves: nhsaves.com

Energy Star® Residential Heating, Cooling, & Water Heating Equipment Rebate

Rebates of up to $500/ton on Air Source and Geothermal Heat Pumps. Rebates of $500 - $750 on Heat Pump Water Heaters. Rebates of $100 on WiFi Thermostats

- Program details and application at www.NHSaves.com/heating cooling

Other NH Electric Utility Programs

See also individual utilities for additional programs and variations. NH electric utilities may offer low or no interest on-bill financing for energy efficiency projects.

Visit www.NHSaves.com/resource/ for individual utility contact information.

Business Programs

Includes programs for: small and large business, new equipment and construction, seminars, lighting incentives, and catalog, and low and no interest financing programs.

Visit www.NHSaves.com/ for information about NH business incentives for electricity efficiency.

NH Weatherization Assistance Income-Eligible Programs

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

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

Community Development Finance Authority (CDFA) Clean Energy Fund

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

to support energy efficiency and renewable energy projects.

Small Business Energy Audit Grants

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

Community Facilities Energy Assessment Grants

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

Find out more at: nhcdfa.org/energy.

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

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

Joshua Singer

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

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

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

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

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

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

Cont'd on p.24

Sustainable Forestry for Biomass, Building, and Products

OpEd: *George Harvey*

Biomass is a very controversial subject. Before we discuss it, however, we need to review the context.

1. Forests naturally change, even without human activity. We might take comfort in the thought that they could remain as they are, but that will not happen without intentional human action. In fact, in many cases it might prove impossible to achieve, and in a time of climate change, forests can change quickly in ways people might not like. To have our forests in the best possible health, we will have to be actively engaged in stewardship.

What would happen if we left all the trees standing? Hemlock woolly adelgids can quickly destroy large stands of hemlocks. Shown is damage in Linville Gorge, North Carolina. (Steve Norman, U.S. Forest Service)

For example, here in the Northeast, invasive species are killing whole stands of trees. Hemlock woolly adelgids have already shown how destructive they can be in southern New England. A survey in 2018 found numbers of them in three counties in Vermont and all but one of the counties in New Hampshire. This, however, is just one of the many threats our forests face from climate change.

2. There are many kinds of biomass used for energy, and the issue of biomass cannot be limited to forest biomass. Agricultural waste of various kinds, municipal waste, and landfills are all possible sources of energy, and they have to be managed to prevent their own problems from arising. For example, farm waste can be fermented in bio-digesters to produce methane, which can be burned for energy; the alternative is to let nature take its course, which releases the methane into the atmosphere where it is a powerful greenhouse gas.

3. There are many ways to use biomass to produce energy, and their use has different consequences. If we burn cord wood in an old model stove, for example, we will make a lot of smoke, contributing to air pollution. By contrast, a rocket mass heater burns wood with enough air that there should be no smoke or creosote, but the extraction of heat is so efficient that the exhaust gases are below the boiling point of water as they leave the flue system, averaging 60°C to 90°C. This means even most of the heat from the water vapor created in combustion is extracted. This can be seen in the Wikipedia article on the rocket mass heater (www.bit.ly/Wikipedia-RMH).

4. There are many ways to use the energy from biomass. We can use it for heat in a home or for a large building. We can use it for combined heat and power. We can use it for electricity. The efficiencies and results of use are different.

5. There are many reasons aside from biomass for energy to harvest wood from forests. These include for buildings, making furniture, paper, and a number of other uses. One by-product of most or all of these is biomass.

One of our readers, Mr. Tim Maker, contacted us after our last issue about our addressing the issues concerning the biomass issues. With a background in biomass energy, he wanted to be sure we included discussions of issues we might otherwise miss. He pointed out that while we really need to practice sustainable forestry, that will be nearly impossible to do without some market for low-grade wood. He said of this, "Look at a forest as a garden with lots of weeds in it. Take out the weeds."

We asked Vermont's professional Forest Climatologist, Dr. Alexandra Kosiba, for her thoughts, and she provided a number of insights. One thing she said was, "Our forests produce some of the best wood around, and they are very productive – often tending to the forest and culling trees not only provides firewood, but also leaves the stand healthier and more productive."

Dr. Kosiba said she does not support forest plantations, "because they do not provide all of the services that a natural forest does and are very vulnerable to stressors." She added, "Along these lines, also important is making sure biomass harvested comes from well managed and sustainable harvests."

Tim Maker stressed in our conversation that the use of biomass should be limited to circumstances in which it is most efficient. He gave the example of a new plant using forest biomass for generating electricity as one that would be likely to have unacceptably low efficiency. "You have to run the numbers," he said.

Cont'd on p.36

Global Warming Is Killing Our Trees

EarthTalk®, from the Editors of E - The Environmental Magazine

It's true that climate change is already affecting tree distribution and forest cover in the United States (as well as everywhere), but only time will tell which tree species are most successful at adapting and whether we will lose significant amounts of forest cover overall.

"A walk in the woods or a stroll on a tree-lined street could be a very different experience just a few decades from now," says U.S. Forest Service researcher Stephanie Worley Firley. "Higher temperatures, altered precipitation patterns, and longer growing seasons predicted for the future could require that some tree species will have to move—or be moved—into new areas where habitat will be more suitable." She adds that some tree species may be able to stay in place by adapting to new conditions, but many others are unlikely to be able to adapt and "may succumb to the pressures of climate change."

Quaking aspens are just one type of iconic American tree species that's losing ground against global warming. (John Fowler, FlickrCC)

One example of an iconic tree species that is already suffering from the effects of climate change is the Quaking Aspen, the most widely distributed tree species in North America. To day the tree is still common in higher elevation regions of Colorado and Utah as well as throughout the rest of the American West, but that might change in the coming decades. Researchers have been tracking the decline of aspens in Colorado for at least 20 years at the hands of climate change and related stressors. Given their shallow root systems, aspens are particularly sensitive to drought; warmer, drier weather overall as a result of global warming means more drought and more trouble for the trees moving forward. Researchers worry that aspens may be gone from the southern (and driest) band of its range within decades, and foresee drastic declines in the tree's overall distribution as temperatures inch up, drought pervades and forest fires rage throughout the region.

Another iconic tree that has already been hit hard by global warming is the Sugar maple, famous as the source of Vermont maple syrup. Warmer winters have already shortened the syrup "tapping" season by more than 10% and if the trend continues there won't be enough winter to sustain the $200 million/year Vermont maple syrup industry. Some other tree species on the ropes thanks to climate change include Balsam fir, Black ash, Paper birch, White pine, Tamarack and Red spruce.

Researchers from the North Carolina-based Eastern Forest Environmental Threat Assessment Center are using forest inventory and analysis data from the U.S. Forest Service to compare where tree species occur presently with a wider range of where they could move or expand given rising temperatures and other changing landscape conditions. By looking at how landscape, weather and temperature conditions will change over the next three decades based on a conservative model of climate change, the researchers can start to project where the most suitable conditions for different types of trees might occur across the country by 2050. This kind of knowledge can help land managers prepare for the changes coming and can help planners map out forward-looking, climate-friendly zoning patterns.

Links: (1) "A Review of the Potential Effects of Climate Change on Quaking Aspen" (www.bit.ly/climate-aspen) ; (2) Eastern Forest Environmental Threat Assessment Center (forestthreats.org).

EarthTalk® is produced by Roddy Scheer & Doug Moss for the 501(c)3 nonprofit EarthTalk. See more at https://emagazine.com. Send questions to: question@earthtalk.org. ♻

Your Nest Has an Impact on Forest Health

Jessie Haas

Like birds and mice, we humans gather fibers from the wider environment to construct, line, and decorate our nests. Since we are a globally dominant species, our nest-building habits have a big impact on the environment, one that's not always easy to see. It's just a chair, it's just a table. We don't see the illegal logging road built out into a rain forest so poachers can cut this exotic tree. We don't see the collateral damage to tropical soils, endangered species, or indigenous peoples. We feel the climate effects of rainforest destruction in hotter days and stronger storms, but we don't connect them to the furniture in our homes.

Organizations like the Forest Stewardship Council (FSC) and the Sustainable Furnishing Council (SFC) work to raise awareness and to certify sustainably harvested wood fiber products, as well as to police the industry, which has a large environmental footprint. Healthy forests are one of our most powerful tools to fight climate change, so forest-based industries have a special responsibility to use responsibly harvested wood.

Unfortunately, illegal logging is a $30-100 billion business, and represents between ten and thirty percent of global wood trade. This degrades forests, damages biodiversity, and deprives legitimate companies of profits. David Gehl, manager of Traceability and Technologies for the Environmental Investigations Agency, Inc, (EIA) likens this to forest mining, and those engaged in it to a forest mafia, whose crimes include overharvesting protected species and areas, bribing public officials, and offshoring illegal profits. GreenPeace estimates that seventy percent of some tropical hardwoods that end up in U.S. and EU markets are stolen, even though importers are required to use 'due care' not to use illegally harvested wood products.

Many organizations have banded together to combat the trade in illegal wood. FSC offers certification. EIA investigates and exposes transnational wildlife and wildlands crimes (as well as campaigning to eliminate powerful refrigerant greenhouse gases.) New technology, including DNA analysis and mass spectrometry, help regulators identify illegal wood. Public maps make it easier for citizens to identify illegal logging operations. In Romania, log truck drivers need to fill out a form on a smart phone app. Anyone who sees a log truck can go on the app, find out if the load is illegal, and report it to the police. Following the app's release, Romania saw a 60% increase in log transport permit applications.

Many protections are built into the manufacturing and importation end of the supply chain, but consumers are still in the driver's seat. Actions you can take include prioritizing recycled, reclaimed, or salvaged wood. Secondhand furniture is a win for the environment. Not only do you cut fewer trees, but the wood in that table or chair is carbon-sequestered for as long as the furniture is in use. Landfills are clogged with discarded furniture, so repurposing it also helps with the disposal problem.

If buying new, look for sustainably harvested wood with a certification from FSC. Check out the Wood Furniture Scorecard on the FSC website. They list and score 18 companies and note if they are making positive progress.

Go on the manufacturer's website to see what their environmental standards are. Many companies state the percentage of wood that is certified and are trying to move that percentage upward. Companies with good records include Etsy Reclaimed Furniture, Vermont Wood Studios, and Copeland Furniture, the last two based in Vermont.

EIA has recently launched a new mobile application, called the Origin app, to help consumers discover the species and geographical origins of the wood in products they buy. If no information is available, users can ping the company to ask them to provide this information to the app.

Local manufacturers are a better bet for several reasons. North American forests are more likely to be well managed, with old-growth forests protected. Also, the carbon emissions from transportation are far less.

Sustainably harvested bamboo is also a good choice. Timber bamboo grows an inch an hour in the spring, reaching its full height in one growing season, taking carbon out of the air at a faster rate than most other plants, and rapidly sequestering it in biomass and soil. After harvest it re-sprouts and grows again. Because it's a grass, it contains minute silica structures called phytoliths which resist degradation. According to Project Drawdown, "The combination of phytoliths and bamboo's rapid growth rate make it a prolific means to sequester carbon." Bamboo can replace many field, forest, and industrial products, including cotton, plastics, steel, aluminum, concrete, wood pulp (for paper) and tropical timbers. While industrial bamboo plantations have the same problems as any other monoculture, bamboo grows readily on degraded lands and can be a way to restore soil, minimize erosion, sequester carbon, and avoid emissions.

Companies specializing in sustainable furnishings are listed in the links, available in the posting of this article on the GET website — and there are many more, helping us line our nests with materials that actually improve forest health.

Jessie Haas has written over 40 books. She has lived in an off-grid cabin in Westminster VT for 36 years. ♻

Celebrating the Forest Industry

Eric Kingsley

Forests, and forest products, are the solution. When we think of so many of the nation's challenges – rebuilding vibrant rural economies, managing our carbon footprint, ensuring a sustainable environment for future generations – it is clear that forests are a critical part of any viable solution. Forests and forest products are vital to us all and can be a core part of addressing some of the biggest problems that confront us.

Carbon emissions – and associated climate change – have become an increasingly visible challenge in the U.S. and worldwide. It is important to remember that forests, and forest products, are a core part of offsetting emissions. Total U.S. greenhouse gas emissions totaled 6,558 million metric tons of carbon dioxide equivalents from all sectors – transportation, electricity generation, industry, agriculture, and residential.

Forests are a crucial counterbalance to these emissions. In 2019, U.S. forests stored 58.7 billion metric tons of carbon – 95% of this was in the forest ecosystem and the remaining 5% in forest products. The carbon in forests has been increasing annually, up 10% since 1990. Forest products play an essential part in this, and in 2019 harvested wood products accounted for 1,521 million metric tons of carbon put into long-term storage.

This reality is impressive, but there is plenty of untapped potential – both to manage forests with carbon as a key product (along with timber) and for long-lived wood products to store carbon. For forests, we have seen some landowners get revenue for storing carbon, but all too often, it is in programs that discourage (or at minimum do not encourage) timber harvesting. That is now changing, with programs today that recognize the opportunities for forest management and timber harvesting to improve forest carbon stocks, including (but certainly not limited to) a program designed by the American Forest Foundation for family forest landowners. The opportunities for forest landowners to get paid for carbon – while providing a steady flow of timber – may increase dramatically in the years to come.

A typical logging site seen throughout the Northeast. (AdobeStock_114135548)

On the manufacturing side, putting wood into long-lived products sequesters carbon for as long as those products remain. Books, houses, furniture all represent stored carbon. But that is just the beginning – work is now underway to develop new products that displace products made with high-carbon materials like cement, steel, and fossil fuels. Mass timber (like cross-laminated timber) allows tall wood buildings to be constructed and "has the potential to substantially reduce the carbon footprint of new buildings by replacing structural concrete." New insulation products that replace fiberglass and foam are coming to market, and efforts are underway to move biochar from a niche industry to a wood-using process that operates at scale, permanently sequestering carbon.

These and many more products – some still not even imagined today – can and will be made from wood. Markets are developing that reward the carbon-sequestering (or carbon-displacing) aspect of these products – they are now established in Europe and beginning to make inroads in the U.S.

All of this – from well-managed forests through finished products – relies on a healthy, robust, and flexible supply chain. Foresters, loggers, mill workers, and others in the forest industries were "green collar jobs" long before the term was coined. We will be even more important in the coming years, as the role of forests and forest products take their place in the carbon discussion.

Eric Kingsley is the Forest Resources Association (FRA) Northeastern Region Consultant, ekingsley@forestresources.org.

This was originally published for Earth Day 2021 on the Forest Resource Association's Woods2Mill blog at www.bit.ly/CelebrateForestry.

Links available in the online version of this article. ♻

BIG BATTERIES ENABLE RENEWABLES

George Harvey

In recent news on electricity storage, one issue that has come up repeatedly is how long the supply will last. For example, lithium-ion batteries are sometimes said to be impractical for storing electricity for more than a few hours. This is confusing, because the batteries will actually store electricity for weeks or months. What is really meant by the "few hours" is not actually how long the batteries will store electricity. What is meant is the amount of time the batteries will be able to deliver electricity if they are discharging at full power.

It is an issue that people who have designed or built small systems dependent on batteries, such as those found in homes, should be able to understand. Part of the design is figuring out the balance between the length of time the backup battery will have to deliver electricity versus the cost of the battery.

For a small system a decision on this issue will require other things to be factored in. For a person with a stove that burns cord wood, in a very well-insulated home, with water fed by gravity from a spring, a minimal system could be small. If the heating system requires electricity, insulation is imperfect, and the pump draws a heavy load, the backup system would need to be scaled quite differently.

The battery systems for utilities have similar issues, though on a very different scale. Utilities have been installing huge batteries lately, far larger than anything that might have been envisioned only a few years ago. The amount of new grid-scale battery additions in the United States has been growing at an average rate of over 23% per year for the last several years, and this is expected to continue, according to the global consulting house Frost & Sullivan, as reported in Solar Industry (www.bit.ly/battery-market).

Part of what is driving the market is a decline in battery costs. An article at *Energy & Environmental Science* explained the extent of the decline. It said the "real price of lithium-ion cells, scaled by their energy capacity, has declined by about 97% since their commercial introduction in 1991 (www.bit.ly/dropping-costs)."

The Raccoon Mountain Pumped-Storage Plant is, in effect, a huge battery. (Tennessee Valley Authority)

All this means much bigger batteries are practical. But the falling cost of batteries is not the only thing going on. The number of new technologies that are being developed is truly astonishing. Flow batteries, liquid-air batteries, super-capacitors, and many more are in development.

Some of the research and development work is just intended to make batteries cost less. Other projects, however, are specifically intended to extend the amount of time a battery can deliver at full power. An article on this, "Big Storage," appeared at *Bloomberg Green*. It talked of batteries that could deliver full power for long times, for example a system that could deliver one megawatt at full power for 150 hours (www.bit.ly/new-battery-tech).

An article at *CleanTechnica* shows why renewable power and batteries are so compelling. "[The] California Energy Storage Alliance estimates the value of storage-backed solar at 2.5 cents/kWh! (kWh is kilowatt-hour) (www.bit.ly/huge-storage)!"

That price, 2.5¢/kWh, is significantly lower than the best price we might expect from fossil fuels. In *Lazard's Levelized Cost of Energy and Levelized Cost of Storage – 2020*, the lowest price for electricity from fossil fuels, combined cycle natural gas from fully depreciated plants, is 2.8¢/kWh. But we are comparing *new* solar plus batteries with *old, paid down* natural gas. If we want electricity at the lowest cost, and we have a fully paid down natural gas plant, the least-cost option would often be to cut down the natural gas plant and replace it with solar panels and batteries (www.bit.ly/Lazard-LCOE-2020).

If our conclusion is that it might be the time to tear down natural gas plants in general, then we can take comfort in the fact that some utilities are already doing just that. Natural gas load-following and peaking plants are being torn down already to be replaced by batteries. What was once California's largest natural gas plant, for example, is being replaced with what will be one of the world's biggest batteries (www.bit.ly/gas-2-battery).

The problem of how long batteries can deliver power is also being addressed in a number of other ways. Research and development of new technologies is just one of them. Demand response using smart meters is another. Yet another is building out transmission lines. Diversifying resources is another. Adding home systems that are available to utilities and bi-directional car chargers is another. And the list goes on.

One more thing to consider is the combination of technologies available. The sun is not always shining, but it often is shining wherever the wind is not blowing. And though the wind may not be blowing in some specific place, for places on the grid it is always blowing somewhere. Any time it rains, the hydro reservoirs fill up. And there are other technologies for generating power.

Long-term battery storage may be one key to having a 100% renewable grid. But we are getting ever closer to having it. ♻

Recycling EV Batteries – *Cont'd from p.7*

Untapped Potential – Sitting in Storage

When an EV battery reaches the end of its life, it must be processed somehow: repurposed, recycled, or disposed of. Because there are no recycling facilities for EV batteries in the United States operating at a large scale today, many retired EV batteries end up sitting idle inside warehouse storage facilities. While this is frustrating, it also means there's significant room for improvement.

Lithium-ion batteries can be expected to last many years, similar to the rate at which most people replace their cars—because of wear and tear on the vehicle, or because old age and use have caused the energy storage capacity of the battery to decrease below optimal performance for the car's owner. At this point, however, two-thirds or more of the battery's original capacity will likely remain: more than enough for operations such as powering charging stations or providing backup power for buildings.

Unfortunately, the lack of standardized packaging, labeling, and chemistries across EV brands today poses barriers to repurposing in this manner. And current waste management policies simply do not take EV batteries into account. Globally, fewer than a dozen recycling facilities are currently processing EV batteries. When fully operational, their combined capacity will only be able to recycle 300,000 batteries each year, or roughly 10% of today's global EV sales. By the early 2030s, this recycling capacity is expected to account for only one1 percent of annual sales. Clearly, waste facilities need a major expansion if they are to keep up with the growth of EVs.

Reusing batteries, recycling materials, and increasing the amount of electricity generated by renewable energy hold great potential to lessen the environmental impact of EVs. As demand increases, policy can play a powerful role in preparing us for an EV future: by setting strong standards for recycled content in new batteries, establishing facilities to responsibly handle retired batteries, developing standards that make reusing batteries more feasible, and adopting strong environmental and labor standards for mining and material processing. Manufacturers, along with state, federal, and international policymakers, all have a role in ensuring EVs are as sustainable as they can be.

For more on EV battery materials and recycling, see www.ucsusa.org/resources/ev-battery-recycling.

Jiayu Liang is the communications assistant at Union of Concerned Scientists (UCS). Nick Iannaco is the multimedia assistant at UCS. ♻

An Energy Makeover at Henniker, NH's Community School

George Harvey

New Hampshire's Henniker Community School (HCS) has had a much-needed energy makeover. The work included a rather diverse group of individual projects, and it was managed by Energy Efficiency Investments (EEI) of Merrimack, New Hampshire, which did much of the work itself. One of the important projects was a rooftop solar array, installed by 603 Solar of Exeter, New Hampshire.

Keith McBrien, Business Development Specialist at EEI called the company an "energy performance contractor." The goal of the company is to reduce the energy use and carbon footprint of a business or organization without increasing its costs. He said, "We worked to help with the school to replace aging equipment with highly energy efficient and renewable energy options to help reduce the energy usage costs of the school."

Henniker NH's Community School has achieved an impressive renewable energy goal with an energy makeover. (Courtesy image)

The work done at HCS was not a simple upgrade. Among the things that EEI did was to replace three roofs. One was a rubber membrane roof that was 25 years old and was replaced by a new rubber membrane. The second was an asphalt roof that was at the end of its life, and the third was a slate roof that was installed in the 1930s. The latter two roofs were replaced with asphalt shingles. In addition, the insulation for the building was upgraded.

EEI replaced the HVAC equipment with variable refrigerant flow heat pumps from Daikin. At the same time, the oil-burning heating system for the school was replaced with one that burns propane. McBrien explained that there were areas in the school, particularly the cafeteria and gymnasium, where propane was considered appropriate.

The fluorescent lighting at HCS was replaced by new LED lights from Phillips. In a school, this is an important upgrade.

McBrien said that EEI works to reduce energy costs of operating the building enough to cover the costs of upgrading the existing system. In the case of HCS, the work included some upgrades that were not addressed in the system being replaced, but which were considered important. All classrooms are now heated with heat pumps, making it possible to add improvements in air quality greatly with increased circulation. This is especially important in an age of Covid-19.

One important addition to HCS was installation of a solar array. The decision to install the array dates back to May 2020, when voters in the town of Henniker, approved installation of a roof-mounted solar array on school

Cont'd on p.25

SUMMER FUN — NO FOSSIL FUELS

George Harvey

When you imagine water sports, what comes to mind? Riding on a speedboat? Perhaps, water skiing? Or are you more inclined toward things that are relaxing, like fishing or sailing? Or possibly, are you inclined to be active, doing such things as rowing in races? Or maybe you go for white-water rafting or kayaking? One thing we can tell you is that you can do just about any of the above noted activities without fossil fuels, so there is no need to pollute the air, pollute the water, and make uncontrolled noise.

An Elco catamaran. (Elco)

The list of fossil fuel-free water sports seems endless. Possibly it is, because new ones keep appearing. Some are old; swimming, sailing, paddling, rowing, rafting and racing, are all known to have existed in ancient times. In fact, it is easy to imagine that the first human swimmers were the first human beings. Newer, environmentally-friendly water sports include snorkeling, scuba diving, water skiing, and kite foil boarding. Some have a practical value, such as fishing.

Some water sports are things we could do alone or in groups, like watching the birds that live on and around the water. There are highly competitive sports, like water polo. And others can be entirely non-competitive, such as underwater photography. Some can be relaxing or competitive as you choose, like sailing. Some are intentionally goofy, like bathtub racing and the beer can regattas that use repurposed cans or bottles to build boats. And some we might think are intentionally bizarre, such as underwater ice hockey, which is played upside down under the ice (no kidding!), though with flippers instead of skates.

And then there are sports that use power boats. For these, avoiding fossil fuels is really important. When oil drips from an engine, it contaminates about a million times its own volume of water. A single drop of oil can contaminate 20,000 liters (5,283 gallons) of water. Combustion engines are equally bad for the atmosphere, adding to the problem of global warming. Concerning the times we are in, we might say, "This is no drill."

There are many kinds of electric boats. Since some of them are rather large and some are very fast, we can safely say that the desire for power boats can probably be satisfied for many people without fossil fuels.

We checked into what electric boats are available. We found an article at plugboat.com that said the fastest production e-boat is the SAY 29E, which set a record at 50 knots (57.5 mph) (www.bit.ly/e-boat-record). And for those who have more money than 99.9% of us, marineinsight.com ran an article in 2019 about the personal submarines it thought were the coolest (www.bit.ly/coolest-submarines).

One company, however, stands out as especially interesting. For one thing, it makes electric outboard and inboard motors that could convert the great majority of power boats to electric. Another thing about it is its history. That company is Elco (elcomotoryachts.com).

Some readers may be scratching their heads, wondering where they had come across the name Elco before. The company was mentioned in the Green Energy Times article, "Craftsbury Sculling Program Enlists Electric Boats," published in September of 2020 (www.bit.ly/e-boats-for-skulling).

Elco is one of the oldest boat makers in the United States. It was founded in 1893. But many people know it because of one particular boat it manufactured, possibly the most famous boat in history, PT 109. PT 109 has been the subject of books and one famous movie, which starred Cliff Robertson. It was commanded by Lt. (jg) John Kennedy, who eventually became President of the United States. The story it told was about his history on that boat, which was destroyed when it was rammed by a Japanese destroyer, and his subsequent actions saving his crew. We may have an article on Elco in an upcoming issue.

We human beings really need to have some fun from time to time, so we can be fresh enough to deal with our problems effectively. In an age of pandemic and climate emergency, we at *G.E.T.* want you to feel good about getting some joy out of life that can be safe for human beings and the environment. Water sports are one way to do that.

Some other related links are: The Electric Boat Association of America was formed in 1992 (electricboats.org). The Duffy Electric Boat Company in California has been making electric pleasure boats for groups of people since 1968 (duffyboats.com). A retailer in the Northeast is New Hampshire Electric Boats. (nhelectricboats.com) ♻

Green Olympics

Cont'd from p.1

the ecological costs of the event, with mixed results. Notably, Rio 2016's promises to improve local air and water quality went unfulfilled, and PyeongChang 2018 spurred the removal of 60,000 trees from an ancient forest on South Korea's Mount Gariwang to make way for a ski slope.

In its quest to go green, Tokyo 2020 (the nomenclature remains) will benefit, unintentionally, from its greatest challenge: the pandemic. 600,000 international travelers, due to arrive at the Haneda an d Narita airports this summer, will instead tune in from home, owing to a public health-based ban on foreign spectators. But the Tokyo Organizing Committee's efforts to reduce environmental impacts began long before COVID-19.

Attentive planning has reduced the Games' expected carbon footprint to 2.73 million metric tons, officially, compared to 3.6 million previously in Rio de Janeiro. Tokyo 2020 will likely claim 100% renewable energy usage for its 17 days of operations, thanks in part to the purchase of renewable energy certificates.

IOC President Thomas Bach visits Tokyo's new Olympic stadium. (IOC/Greg Martin)

A host of small, tangible measures aim to demonstrate Tokyo's commitment to conservation. In 2017, the organizing committee asked Japanese citizens to turn in old consumer electronics like cell phones, whose subsequently harvested metals now make up the Olympics' and Paralympics' 5,000 gold, silver, and bronze medals. Victorious athletes will stand on podiums composed of post-consumer plastic, which has additionally served as the material for the torchbearers' uniforms.

The Olympics will also give Japan a chance to showcase its long-term vision for a hydrogen-based economy. Once created, hydrogen burns without emitting carbon, but for now, its costly production typically relies on fossil fuels, and the US Department of Energy has not prioritized its development as a clean energy source. In Japan, however, the gas is currently lighting the Olympic torch through sections of its route to Tokyo and will fuel the iconic Olympic cauldron once the Games have begun. More significantly, 500 hydrogen fuel cell cars will reportedly transport Olympic staff between venues, and fuel cell buses will join battery-electric shuttles in moving fans.

In recent decades, the IOC's demands for state-of-the-art facilities have led host cities to waste millions of tons of steel and concrete on "white elephants": vast new structures that, after accommodating a round of Olympic events, tend toward vacancy. Tokyo 2020 hopes that its eight permanent new venues – fewer than Rio or Beijing, the same number as London – will avoid this fate through continued use as "valuable public property," in the words of the organizing committee, in addition to fostering an estimated 71,860 newly planted trees. (Paris 2024 has trimmed its construction plan to just one permanent new athletic facility.)

For its 10 temporary venues, Tokyo 2020 has pledged to make use of preexisting materials in the form of rentals and leases for tents, lights, and bleachers. And with the help of the Tokyo Metropolitan Government, the organizing committee seemingly intends to leave the 25 competition sites that predate the Olympic bid in better shape than it found them, through projects, for instance, to reduce waterborne E. coli at Odaiba Marine Park and to conserve wetlands at Kasai Rinkai Park (though another section of Tokyo Bay now lies behind concrete walls, erected to provide flatwater for rowing events). "Seabins" installed at Enoshima Yacht Harbor have already begun to collect marine debris.

At the Olympic Village, diners should, according to Tokyo 2020 officials, expect to consume GAP-certified produce, eco-labeled seafood, and similar items on recyclable or reusable dishware. But they may want to look closely to be sure: in preparation for the Games, Tokyo's organizing committee put together a "sustainable sourcing code" to weed out irresponsible suppliers for goods ranging from palm oil to paper, yet a 2018 scandal revealed that tropical plywood from Malaysia and Indonesia, purchased from companies associated with illegal logging and deforestation, had served to mold concrete for the new National Stadium, casting doubt upon the code's stringency.

Japan's government has presented Tokyo 2020 as a celebration of national and regional recovery following the 2011 tsunami-induced nuclear

Cont'd on p.25

Green Energy Times Is Twelve Years Old

A message from N.R. Mallery, founder of Green Energy Times

This 66th edition of *Green Energy Times* marks our 12-year anniversary. We have come a long way since the first issue was released on May 4, 2009.

When I look back at how seldom one would see solar at a home or business back then and look at how solar today is a very common sight, it warms my heart to think that *G.E.T.* may have contributed to helping with our change to a clean-energy future.

G.E.T. was founded because there was a need to share my own story about how well solar and efficiency really does work, and to make connections with others who were doing the same. It was important not only to tell and share our solar stories, but also to let people know how to connect with the businesses that could help them achieve energy independence. At the time *G.E.T.* was founded, energy independence was the key goal. But as time passed, it became very clear that this was also part of the puzzle to help in the fight against climate change and lead to our future.

It started with my own story of going solar, off the grid. This meant that I needed to learn how to get my energy needs down, so that the small 3.8kW solar system I could afford would meet my needs. Two sources that I credit with helping me learn how were the *Solar Living Source Book* (my bible) and Efficiency Vermont. An energy-efficient home was built, the solar PV and solar hot water was installed, and it worked!

People started to visit and were amazed that I could live a normal lifestyle with solar providing the electricity to meet my needs. School groups and tours from local events would visit. I would give the same speech showing how it all worked again and again. I knew that it was time to let more people know that solar works, how it works, and how others can do likewise. With no money, I created a newspaper that could accomplish this, with just the advertising to pay for the costs to publish and distribute it in the local region surrounding Bradford, VT.

And look at *G.E.T.* today, with readers throughout VT, NH, NY and well-beyond. It takes a lot of long, hard work to produce each issue. We hear from readers every week about how much they love what they read and learn from the pages of *G.E.T.* We hear of stories of what others have been able to accomplish, and we smile to think that *G.E.T.* may have been just a piece in the puzzle that helped them. It is amazing to witness the changes happening all around us as we walk our path to a sustainable planet.

From the day *G.E.T.* was founded, we had a vision to change the world starting in the area where I live, but *G.E.T.* continued to evolve because you wanted it. We would not be here without you.

G.E.T. has been showing a path to sustainability for the past twelve years, but we're just getting started on saving the planet. There is much work ahead of us all to assure that we have a planet which the next generation can survive on.

We are thankful to each of you for everything you do and proud to be a part of a clean, renewable future for us all.

Thank you for your continued support!

– Nancy Rae

Messages From Some of Our Supporters

"Congratulations G.E.T. *on your important work in the Upper Valley for the past 12 years. ARC appreciates your efforts towards a resilient future for us all." — Kim Sager, ARC Mechanical Contractors, arcmech.com*

"BetterNotBiggerVermont and Green Energy Times *have very similar goals. I am very pleased to have given a lot of time to both endeavors." — George Plumb, betternotbiggervt.org*

"Thank you for your most excellent work to keep us informed. Knowledge is the key to change. Wishing you all peace, love, health and happiness and many more years ahead." — Paul and Joanne Coons

"Congratulations on twelve terrific years of teaching us all how to make a difference and build a better world!" — Jen White, Colby-Sawyer College, colby-sawyer.edu/sustainability

"Congratulations to the entire staff of G.E.T. *on their anniversary. I always find the articles by their editorial writers to be objective, factual and thought provoking.* G.E.T. *founder Nancy Rae Mallery is a true treasure to the cause of sustainability." — Keith Dewey, architect AIA-LEED AP, Certified Passive House Designer*

"Congratulations, G.E.T.*! Thanks for leading the way to a fossil free future!" — Green Energy Options, greenenergyoptions.com*

"Over the years we have enjoyed reading G.E.T. *and all your coverage of energy and climate action topics. Keep up the good work and together let's make the planet green again!" — Montpelier Construction, L.L.C. Montpelierconstruction.com*

"Your publication is a gem for this region. We love the consistent no-nonsense coverage of climate issues and solutions. We are proud to read and support Green Energy Times. *Congratulations on 12 years and here's to many more." — Ted Vansant, New England Commercial Services, necsolarservices.com*

"NH Sierra Club wishes Green Energy Times *Happy Anniversary! We count on your publication to share the important stories addressing the climate crisis for the many intersectional impacts on our daily lives; as well as the businesses, communities, institutions, and organizations bringing solutions for all people to learn and apply." sierraclub.org/new-hampshire*

"Thank you G.E.T. *- You're a beacon to the future we all hope to see!" — Bill Nowak, Buffalo, NY*

"The New York Solar Energy Society is pleased to distribute Green Energy Times. *It is the best publication resource ever and has been a major program of ours for 8 years. Congratulations on your 12-year anniversary." NYSES, nyses.org*

"Happy 12th Anniversary to Green Energy Times! *Your publication is like a breath of clean air." — Randy Bryan, PlugOut Power LLC, plugoutpower.com*

"We would like to thank Green Energy Times *for supporting our business! Thanks for sharing pertinent industry news that educates and encourages clean energy support, investment, and participation. As we grow and expand in VT, NY, and MA, we look forward to sharing our work with G.E.T. readers." — Power Guru, power-guru.com.*

"Renewable Energy Vermont applauds Green Energy Times *for its legacy of clean energy leadership! For more than a decade, G.E.T has helped guide the way to a resilient, local, renewable energy future in Vermont and New England. Thank you for making such a difference with your hard work!" -- REV, revermont.org*

"Congratulations on a great milestone G.E.T.! *Every issue is filled with great stories to continue to learn about what our communities are doing and ReVision Energy thanks you for your tireless work." — The Revision Energy team, www.revisionenergy.com*

"Congratulations on your anniversary! And thank you to the Green Energy Times *community as we work for a sustainable future." — RSTThermal.com (RenewAire)*

"Sustainable Hanover and the Town of Hanover are so grateful for the leadership Green Energy Times *has exercised in our region over the years! Bravo for showing us all the way to our sustainable, green, resilient future in our very special corner of New England!" — Sustainable Hanover and the Town of Hanover, www.hanovernh.org*

"Congratulations on 12 years!" — Sustainable Heating Outreach & Education, Sustainable-Heating.org

"Southern VT Solar believes in the power of community! Thank you G.E.T. *for providing a rich, green network for people in our area to tune into and take action for a clean energy transformation. Happy 12 years – and many more!" — The Southern VT Solar team, svtsolar.com*

"Congratulations G.E.T. *for 12 years successfully dedicated to highlighting the vital information needed to make our world, and particularly our region, more sustainable and energy efficient." — Steven Winter Associates, Inc., swinter.com*

"Vermont Passive House looks forward to every issue of G.E.T. *and is always excited to follow your coverage of High Performing and Passive House Residential and Multi-Family projects. Keep up the good work!! PH Design + Minimize Embodied Carbon + Electrify Everything + 100% Clean Energy = Climate Action!" — VTPH.org*

"Congratulations on the last 12 years! Thanks for being a great advocate in helping keep the community connected, educated and updated on clean energy and green living!" — Wright Builders (wright-builders.com)

"The feeling I get each time I read Green Energy Times *is the same feeling I get from attending events such as Efficiency VT's Better Buildings by Design conference. It's an exciting reminder that there are thousands of other people in our area and globally who are working hard toward implementing on-the-ground changes to our resource use that are absolutely necessary if we want to maintain any sort of global ecological health." — Nate Gusakov, Zone 6 Energy (a division of Silver Maple Construction), zone6energy.com.* ♻

How To Choose A Geothermal Installer

Joe Parsons

Geothermal heat pump systems can be used to heat and cool your home, thanks to Earth's insulating properties. Because most of your indoor comfort needs are right under the ground, it saves on your demand for electricity, gas, or oil. A home geothermal heat pump can cut bills by thirty to seventy percent, paying for itself within the first few years after installation.

Drilling for geothermal installation at a home . (Photos: courtesy of CLimateMaster)

If you've done your homework about geothermal, knowing it's the right fit for you, it's time to take an exciting next step, choosing an installation contractor!

Choosing a contractor to install your entire system is an integral part of the process. Approximately seventy percent of the energy used in a geothermal heat pump system is renewable energy from the ground. And tapping into this energy source requires proper training. Don't make the mistake of thinking you can call the HVAC technician that usually does your air conditioning service for advice. Geothermal horror stories happen when unqualified contractors do the installation.

With geothermal, there are at least twice as many things you have to consider, making it two times as likely for a mistake with the wrong installer. The bar must be high, and you, as a consumer, want perfection.

No one wants to deal with improper design, leaks, or complications with setup. Good contractors will tell you what equipment they plan on using and how they will lay out your geothermal loop.

Request a very detailed proposal and a report showing unit performance, anticipated operating costs, and a baseline representing what you're paying now.

The Ideal Geothermal Installer's Credentials Should Be Proven

If you can't just set up an appointment with any local contractor, you may be asking yourself how to know what the right installer looks like. First and foremost, don't select someone who dabbles in geothermal–you'll be in for a lifetime of hurt. ClimateMaster supplies geothermal units and works with certified GeoElite dealers across the country. You can use our GeoElite dealer locator here.

Good contractors are doing twenty to thirty installations a year in a mid-sized area, fewer in rural communities, but even more in densely populated areas. Be sure that your installer has at least a typical number of installations per year for your peace of mind.

The IGSHPA, International Ground Source Heat Pump Association, set up standards, practices, and training programs for designers and installers to follow as a bare minimum requirement. The installer you choose should, without exception, be IGSHPA-certified.

It's always a good idea to get customer referrals on any purchase, but with this kind of investment, you're sure to need some input from people who are currently using geothermal technologies in their homes. Ask any potential installer for names of customers, builders, and dealers they've worked with before. These credentials alone will give you a good idea about whether or not to move forward.

Many thanks to our section sponsor:

CLIMATEMASTER

Questions to Ask When Looking for Your Installer

A few initial questions can quickly reveal if you should hire a particular installer. First, ask if they have been through geothermal manufacturer's training and, if so, which brands they install. Typically, if a contractor will sell you any brand on the market, they might not be the expert you're looking for. Most qualified dealers have a brand or two they've grown to know and trust from experience.

Next, they must have fusion technician training. Ask if your installer is certified to weld geothermal tubes together. Be sure to confirm that their technicians carry these certification cards and ask about when and where their last install was.

Cont'd on p.23

Professional geothermal contractor installing a ClimateMaster Heat Pump

Historic Net-Zero Air BnB Features Air-to-Water Heat Pump

Dan Vastyan

Johnathan Matthew and Tracy Roux are proud to join the ranks of energy-efficient, fossil-fuel free Airbnb owners in the state of Vermont.

Their farmhouse, set on 50 acres near Plainfield, VT, was built in 1791 and added to extensively in 1827. Matthew purchased the property in 1997.

"We installed a large solar array on a barn roof in 2015," said Matthew. "The property is now an operating Airbnb. We're closed at the moment due to COVID-19, but we'll open again as soon as possible."

Built in 1791, the farmhouse is now one of the few fossil fuel-free Airbnb properties in Vermont. Rt: Solar PV was installed on the barn roof in 2015.

The 2,100 square-foot farmhouse has experienced many efficiency upgrades since 1997. The final component of the renovation was an HVAC system upgrade from its existing oil-fired furnace.

Matthew owns a spray foam insulation company, All Seasons Urethane Foam, and has worked extensively with Lloyd Plumbing, Heating and Gas Services, LLC, in the past. He and Jonathan Lloyd, comfort advisor and project manager for Lloyd, held several meetings to discuss the best options for the historical home.

The primary objective was to remain as environmentally-friendly as possible and tap renewable energy. Reaching that goal took some deliberation, and they weren't sure to what degree they could minimize the home's carbon footprint.

"The existing 13.8kW solar array was a great start," said Lloyd. "Matthew and I discussed the use of a pellet boiler, but this didn't address the need for air conditioning. He also considered the use of ductless heat pumps, but he and Roux preferred a radiant heat system for premium comfort. We hadn't reached a conclusion by the time I was contacted by Efficiency Vermont, who had been working with a manufacturer to bring a new, state-of-the-art, all-electric heating and cooling technology to Vermonters."

Beta test air-to-water heat pump

The professionals at Lloyd P&H are well known by managers at Efficiency Vermont. In 2019, the company was presented with Efficiency Vermont's Partner of the Year award.

Lloyd explained to Matthew that Mark Chafee, VP of governmental relations and sustainability at Taco Comfort Solutions, had approached Efficiency Vermont for assistance in identifying a beta test site for Taco's soon to be released air-to-water heat pump system. Taco Comfort Solutions, based in Cranston, RI, is an American manufacturer of hydronic HVAC components and is known industry-wide for its forward thinking and development of class leading, high-efficiency products.

Taco's pre-release System M air-to-water heat pump is installed at the farmhouse, supplying hot water to both the home's large indirect water heater and its main hydronic panel. Left: A technician from Lloyd Plumbing & Heating selects a pumping mode from several available on the Taco 0018e circulator.

Taco's new System M heat pump, to be released soon, is a turnkey air-to-water heat pump that provides heating, cooling and domestic hot water with zero fossil fuel emissions. Much like a conventional unitary heat pump or a ductless mini-split, the system includes an indoor and an outdoor unit. But the similarities end there.

The outdoor unit of Taco's System M is a stylish, quiet condensing unit powered by a radically efficient variable speed inverter and fan combination. The indoor unit houses a complete package of pumps, controls, and piping accessories ready to send chilled or hot water to all types of HVAC heating and cooling distribution systems. This can include hydronic coils for use in ductwork, convectors, radiators, unit heaters and radiant tubing, giving contractors, architects and homeowners nearly limitless options for premium comfort, architectural flexibility and energy efficiency.

"This system is truly an appliance, not an amalgamation of heat pump parts sold by different manufacturers, which has been the only option for an air-to-water pump in the U.S. until now," said Lloyd. "Taco has packaged the indoor and outdoor portions of this system in one cohesive, interconnected appliance. As a factory package, this cuts installation time in half."

"Our air-to-water heat pump incentive program began in 2019," said Brian Sweeny, supply chain account manager at Efficiency Vermont. "The biggest hurdle is lack of contractor familiarity with the systems. That results in higher prices for the systems, putting

Cont'd on p.35

Geothermal

Cont'd from p.22

Don't forget to check on essentials such as: if the company provides load calculations before installation, if they service the unit, and if they have their own service department. Questions like these will prevent you from hiring a person who may want the sale but doesn't exactly know what he or she is doing. For an in-depth explanation and checklist, energy.gov provides an excellent resource for consumers considering switching to geothermal.

Lastly, ask your installer about available local and federal energy incentives and rebates. Most reputable geothermal installers should have this memorized.

When you take the time to ask the right questions, a residential geothermal installation will be a task you can approach with confidence!

Geothermal ground-loop pipe being installed

Are you ready to interview geothermal installers? Download the contractor comparison guide (https://pages.services/content.climatemaster.com/how-to-choose-a-geothermal-installer) now to help make the best decision.

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 VERMONT HOMEOWNER'S EXPERIENCE

Getting a Solar Array is Easy. Getting Rid of Oil-fired Heating Systems is a Challenge

Eve Endicott

The 20kW solar array, which is located up hill and invisible from the house, will provide the electricity needed for the new electricity-driven heating system which will replace oil heat. (Images: Oliver Ames)

When I saw the place my sons chose for a family compound in southern Vermont, replacing one owned farther north, I worried about how they would afford to pay for heat on top of the high taxes. Environmentally conscious and spurred by the declining federal tax credit, I hoped the property's two aging oil tanks could be replaced with solar. The purchase-and-sale agreement was written to allow for an assessment of the property's solar potential, which was quickly performed by Southern Vermont Solar (SVS). A few months later, SVS had installed a 52 panel, 20kW, ground-mounted array high on a hill behind the house, out of sight, hooked up by wiring in a long, deep, invisible trench.

It turned out that getting the solar array up and running was the easy part. Converting the heating systems to run on electricity was more challenging. The larger, older house promised to be straightforward. A mini-split heat pump for the semi-detached playroom and a ducted heat pump for the forced hot-air system in the rest of the house, would afford both heat and (rarely needed) cooling. Both heat pumps qualified for rebates from the state.

The small, modern guest cottage on the property was more difficult. It had a combination of radiant heat and radiators, with a boiler that also heated the domestic hot water, thus burning oil year-round.

Being new to the area, I reached out for suggestions of contractors. One highly recommended company's representative personified man-splaining. I told him we wanted a small system in the cottage, which we expected to use intermittently, relying largely on a woodstove when people were there and small electric heaters to warm pipes when they weren't. The contractor came back with a proposal for a huge air-to-water heat pump and separate hot water heater that would cost over $50,000, warning me that I would be 'liable' in any future sale if we undersized the system. Fortunately, I knew that was nonsense. A subsequent bid from a different contractor for a similar system came in at half that amount. Buyer beware.

With the cost for an air-to-water heat pump for the cottage still high, however, but the oil tank in the cottage almost empty and ready for removal, the immediate need was to heat domestic hot water. We embarked on a long and frustrating assessment of heat pump hot water heaters. Their tanks were too tall for the cottage's low-ceilinged basement. An enclosure in the garage would be needed. Everyone (plumbers and Efficiency Vermont) had a different opinion about the necessary size of such an enclosure, from 4 feet x 4 feet to 10 feet x 10 feet or larger. Whatever size it was, it would be expensive, and the heat pump would generate cold air that would need venting. Finally, we wanted to be able to turn the heat pump on and off remotely, so as not to heat water when it wasn't needed while having it hot when guests arrived, but our new contractor didn't use the "smart" heat pumps.

Finally, I had a brainstorm. What about an electric, on-demand system? The contractor was dubious that there was enough 'juice' in our already almost-full electric panel. "How much would we need," I asked? Answer: at least 50 amps for the shower and sink in the main bathroom, 50 for the kitchen sink, 25 for the second bathroom sink, and more for the laundry and dishwasher – over 150 amps! Why, I wondered, would we need to be running the washing machine or dishwasher at the same time as the shower – or for that matter, running three sinks simultaneously? And weren't we supposed to be washing clothes in cold water now? Ultimately, the family installed a very affordable 80-amp system and it works just fine. The fact that it only runs when people need it suits the intermittent needs of a guest cottage perfectly, with the bonus that, if guests are numerous or showers are long, no one ever runs out of hot water.

Replacing the previously oil-fired hydronic heating system in the cottage with one that can use the solar-generated energy is more of a challenge. For the moment, the woodstove and two or three oil-filled space heaters do the job when people are there. When they aren't, a small, wall-mounted, quiet Envi heater in the bath/laundry room and another one in the basement keep those rooms and the pipes warm even in the dead of winter, using only 450 watts each.

There is probably an air-to-water heat pump in our future, especially if the cost comes down and the state continues to offer a significant rebate. One issue is that some rooms in the cottage get very hot in summer, and air-to-water systems don't really offer cooling, unlike air-to-air systems. That may change with new technology.

Meanwhile, the family will be saying goodbye to oil at last, trying to do our part to help fight climate change!

Eve Endicott is a regular reader of G.E.T. *whose family's home is in Brookline, Vermont. She has enjoyed a 45-year career in land conservation and still volunteers for land trusts.* ♻

A compact Envi 450-watt heater in the bathroom and basement keeps pipes warm.

NH Tax Credit for Biomass Heating

Cont'd from p.15

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

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

A scenic New Hampshire forest. (Giorgio Cantoni, Unsplash. www.bit.ly/3f9S5yr)

Green Energy Investments in VT Mean Jobs

AND WEATHERIZATION OPPORTUNITIES

Carolyn Sweet

There is a growing call for Vermonters to sign on as eco-warriors as state and federal governments increase investments to grow the number of green jobs and weatherized housing units statewide. Investments in weatherization have shown to actually reduce carbon-based pollution throughout VT and increasing investment levels will help the state to reach the 2025 carbon emissions goals. Primary sources of carbon emissions in the state are the result of the heating and transportation sectors, according to the VT Greenhouse Gas Emissions Inventory Update. Vermont's Community Action Agencies (VT CAA) play a leading role in ensuring that all state residents have the opportunity to benefit from statewide investment by offering no cost weatherization and efficiency coaching and upgrades to Vermonters whose income level would otherwise restrict their financial capacity to participate. Energy investments through VT CAAs both reduce household costs related to energy use, especially heating costs, and simultaneously allow all community members to play their role in reducing the state's overall carbon footprint.

Energy efficiency upgrades can be cost-prohibitive to lower-wealth community members, often limiting their participation in community-wide carbon footprint reduction. By creating no-cost funding mechanisms for all community members to participate, Vermont moves toward further reducing emissions within the heating and transportation sectors, which currently represent 70% of the state's carbon emissions. No-cost weatherization services can include:

- Home energy audits performed by a highly trained energy efficiency auditor who will conduct a comprehensive home audit to determine what can be done to improve energy efficiency in the home.
- A comprehensive plan to weatherize a home that includes air sealing, insulating, duct sealing, improving heating and cooling systems, minor repairs and health and safety improvements.
- Energy efficiency upgrades on electric water heaters, lighting and old appliances in partnership with Efficiency Vermont.

Services result in lower heating bills, increased comfort in the home, increased health and safety, and a smaller carbon footprint and impact on the environment. For community members interested in upgrades yet not eligible for VT CAA no cost weatherization and energy efficiency services, Efficiency Vermont is available to help by providing guidance and offering a variety of financial support which can defray the cost of energy upgrades.

SEVCA weatherization crews provide no cost weatherization and efficiency upgrades to renters and home-owners of both single-family and multi-family homes. (SEVCA)

Vermont's growing investments in the green energy economy continue to result in the addition of more jobs to the green employment sector. For example, most Community Action Agencies operate state-funded weatherization departments statewide and increased funding will result in more Energy Auditors, Energy Efficiency Coaches, and Weatherization Crew Technicians. With commitments of increased funding over the upcoming years from both federal and state sources, at a smaller agency like Southeastern Vermont Community Action (SEVCA), this can mean as many as four to six new jobs next year. According to SEVCA's Weatherization Program Director Victor Baisley, "It's a great day for weatherization and the green economy. Significant funding has been secured for training and hiring in the weatherization sector, and SEVCA hopes to get into as many homes as possible to weatherize those homes and save folks money on their heating bills. Contact SEVCA for employment opportunities!" Crew members in VT and nationwide receive extensive paid training in state-of-the-art weatherization and efficiency modifications. When translated to the home, services provided by weatherization services typically see a 46% reduction in overall home energy use.

SEVCA weatherization crews provide no cost weatherization and efficiency upgrades to renters and home-owners of both single-family and multi-family homes.

Growing weatherization services for all will play a key role in ensuring that Vermont meets the 2025 carbon emissions goals. SEVCA and Community Action Agencies throughout Vermont and nationwide play a critical role in ensuring that all community members are able to access resources which diminish home heating costs while simultaneously reducing carbon emissions. As investments in these weatherization programs continue and increase, expect to see a growing number of jobs in the green economy. Those interested in learning more about no cost weatherization and energy efficiency upgrades for eligible community members can locate their regional Community Action Agency at https://vermontcap.org/. Growing a green economy through energy-efficiency investments is an important part of Vermont's carbon emissions reduction plan and plays a key role in increasing the state's green employment sector.

Carolyn Sweet is the Director of Planning and Development for Southeastern Vermont Community Action. In addition to offering no cost weatherization services, SEVCA is also home to Community Solar for Community Action, a solar array project in VTwhich provides energy credits to fifty households in Windham and Windsor Counties, VT. The agency offers numerous services to eligible community members. For more information, visit www.sevca.org, https://dcf.vermont.gov/benefits/weatherization, or contact csweet@sevca.org. ♻

Green Olympics

– Cont'd from p.20

disaster in Fukushima, where radioactivity displaced 50,000 households. But critics say that the infrastructural upgrades demanded by the Olympics have diverted resources away from the ongoing decontamination and reconstruction in Fukushima, and the Games' triumphal narrative has incentivized public officials to whitewash remaining health hazards while urging former residents back into their homes.

Tokyo's Olympic and Paralympic mascots, Miraitowa and Someity. (Tokyo 2020 and Tokyo Metropolitan Government)

NOlympics LA, an activist group formed in advance of the 2028 Summer Games, traveled to Tokyo in 2019 for "the first-ever transnational anti-Olympic summit," as some media called it. "We saw massive amounts of development, both directly and indirectly tied to Tokyo 2020, and we doubt any of that was very sustainable," organizer Jonny Coleman recalled. "We saw the destruction of public parks for more Olympic development, just like we're seeing take place in the name of Paris 2024 at the moment."

In the view of Dr. Satoko Itani, a professor who studies sport at Kansai University, the Olympic motto Citius, Altius, Fortius (Latin for "faster, higher, stronger") appears to have inspired not only Olympic athletes but over-ambitious planners in host cities. "This is the mantra of modernity that has led us to this catastrophic environmental degradation," they told *Green Energy Times*. "In order to protect the environment, we have to learn to de-develop, meaning learning to value and live life slower and smaller, not trying to go or make something faster, taller, stronger."

The IOC, unsurprisingly, takes an optimistic view of the role of the Olympics in an eco-friendly future, having announced last year that, through the planting of an "Olympic Forest" in Africa and various harm-reduction measures, the Games will become "climate positive" by 2030. "We want to ensure that, in sport, we are at the forefront of the global efforts to address climate change and leave a tangible, positive legacy for the planet," IOC President Thomas Bach stated.

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

Henniker School

– Cont'd from p.19

buildings. The cost was expected to be slightly less than $295,000. The solar array was to be just part of a needed upgrade for energy efficiency.

The array was designed, engineered and is now monitored by 603 Solar while the physical installation, inspection and commissioning was performed by Adams Energy of Canterbury, NH.

The array at HCS is impressive. It is expected that the solar array will generate about 115,000 kilowatt-hours (kWh) of electricity each year, equivalent to reducing greenhouse gas emissions of 81.5 metric tons. According to Keith McBrien, this is sufficient to offset about half of the school's electricity use. It has a total of 250 Hanwha Q.Peak Duo 400-watt solar modules. These are tied to two 43.2 kWh Solar Edge three-phase string inverters.

The array is set up on a ballast block racking system from Ecolibrium Solar on four flat roof areas.

Zach Haithcock of 603 Solar said, "We love working with schools and municipalities to realize their renewable energy goals. Not only are they really fun projects to work on, but they also raise awareness in the area regarding renewable energy. When you see your local school or town hall install solar, it really gets people's attention and motivates them to look into it for themselves!"

Haithcock said 603 Solar and EEI had worked together before when the Newmarket, NH fire department had similar work done using similar equipment. ♻

Waters That Can Emit Greenhouse Gases or Draw Them Down

George Harvey

Water is amazing. So are the things that live in it. In fact, some things we seldom think about and seem to have nearly no value, could turn out to be the things that save us. Consider peat bogs. At the website of the International Union for Conservation of Nature, we find this interesting statement: "Peatlands are the largest natural terrestrial carbon store; the area covered by near natural peatland worldwide (>3 million km2) sequesters 0.37 gigatons of carbon dioxide a year – storing more carbon than all other vegetation types in the world combined (www.bit.ly/peatlands-data)."

Growing peat bog. (Agnes Monkelbaan, CC-BY-SA 4.0, www.bit.ly/38OKcvg)

Unfortunately, while peatlands can be powerful allies for drawing down carbon dioxide (CO_2), they can also be serious greenhouse gas emitters. That can happen if they are damaged. So, restoring a peat bog to good health can be a powerful act to help with climate change. For those who are especially interested in peatland, we might suggest visiting the website of the International Peatland Society (www.peatlands.org).

There are other wetlands, apart from peatlands. They may not all be as valuable as peatlands for drawing down CO_2, but they are similar in important ways: While they can draw down CO_2 if they are healthy, they can emit CO_2, methane, and nitrous oxide if they are not. These other wetlands can also be valuable ways that peatlands are not, for example as sources of food.

Recently, an article posted by the BBC went into the carbon value of healthy rivers versus the costs of those that are damaged. This article, "The Rivers that 'Breathe' Greenhouse Gases," took an especially close look at the rivers in Hong Kong's New Territories (www.bit.ly/Hong-Kong-river). This region has a large population, but it includes rural areas with farm land.

The New Territories region has waterways running through it, which, if left in a natural state, would take in CO_2 and breathe out oxygen in a natural cycle of respiration. Instead, the waters are so overloaded with CO_2, nitrous oxide, and methane that the air above them does not need any other source of these chemicals to be badly polluted.

Part of the problem with the water is the farmland. The runoff from the farms includes waste from livestock, along with residues of any chemicals or organic materials that might have been used to fertilize the land. In addition, there are scores of thousands of people who live in buildings with no connection to any sewage system.

The result of the situation is that the microflora in the waterways are species that can live in such an environment. Operating on the food they find, they produce toxic by-products. Where one set of microbes, living in unpolluted waters, would act to maintain the purity of the water, and with it the air above it, with polluted water a different set of microbes makes the pollution worse.

Somehow, this seems very much like things that are going on closer to home. Whether it is the Connecticut River, Lake Champlain, the Hudson River, or any other body of water, allowing pollutants into the water can make that water even more polluted.

We have known, for example, that farm runoff going into Lake Champlain can feed cyanobacteria, causing "algae blooms." This makes the water of the lake even more toxic and kills fish.

Clearly, part of the issue is simple. Treat the waters well, so the environment they provide is healthy, and we have a valuable friend in the fight against climate change. But treat the waters badly, and they become a powerful enemy. ♻

TWO WAYS TO LOOK AT EARTH

John Bos

Screening out unpleasant and unwanted realities has become the norm for far too many of us in first-world countries. Constant streams of carefully crafted propaganda from the power structure have been used to polarize, divide, and deceive, causing an epidemic of voluntary blindness. This is an accurate description of our current political climate. As damaging to our democracy as this is, it pales in comparison to the compromised comprehension of our climate emergency. In other parts of the world, people are increasingly engaged in a daily fight for survival. Denial of our worldwide climate crisis is not an option for them.

With Covid-19 occupying center stage, particularly in third-world countries, the question of people's survival is the clear and present danger commanding primary attention. Here in America our next compelling concern is reviving the economic climate. As a result, the greatest existential threat in humankind's history has been relegated to the back of the climate classroom.

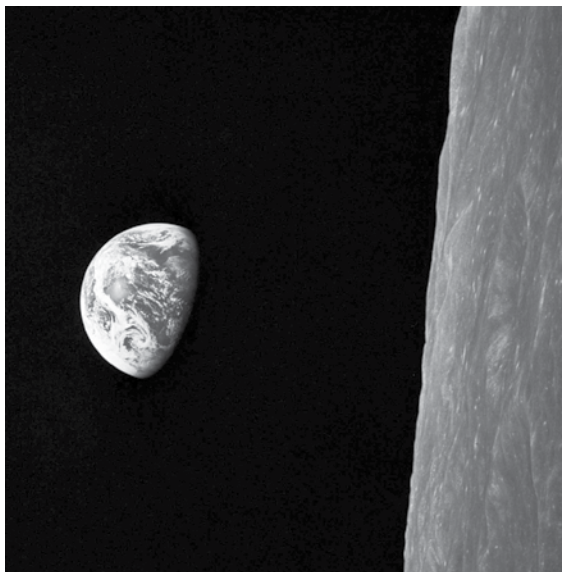
Journalist Amy Westervelt, in the April 19, 2021 edition of Nation magazine wrote, "In the absence of government funding for research into a wide range of climate solutions or even the political will to say that we need to stop drilling for fossil fuels, I'm also concerned that we're left with corporate philanthropy, a system that enables wealthy individuals to create policy without participation in democracy."

Meanwhile, in the skies above, global climate engineering operations continue to be the crown jewel climate weapon of the military industrial complex. The lingering, spreading and sun-blocking jet aircraft trails are not just condensation as we have been told by government sources. The dimming of direct sunlight by aircraft dispersed particles, a form of global warming mitigation known as "solar radiation management," is ongoing. These global climate engineering operations are causing untold damage to the planet's life support systems and human health.

But, no matter how obvious and blatant the ongoing geoengineering operations are, the official denial of the climate engineering reality is resulting in public apathy about this critical, existential threat to planet earth and to all its inhabitants. Putting "profit before the common good," Westervelt says, the problem "will not be solved by new technologies laid atop the very system that created it in the first place."

There has always been more than one way to look at things; from the bottom up or top down. Or sideways. Or to avoid looking at all if you are locked into an unshakeable belief about the matter under discussion.

The science writer Elizabeth Kolbert has tweeted, "Two words that probably should not be used in sequence [are], "good" and "Anthropocene." In her book, The Sixth Extinction, Kolbert draws on the work of scores of researchers in half a dozen disciplines, accompanying many of them into the field: geologists who study deep ocean cores, botanists who follow the tree line as it climbs the Andes, and marine biologists who dive off the Great Barrier Reef. She introduces us to a dozen species, some already gone, others facing extinction, including the Panamanian golden frog, staghorn coral, the great auk, and the Sumatran rhino. Through these stories, Kolbert provides a moving account of the disappearances occurring all around us and traces the evolution of human-caused extinction.



Earthrise is a photograph of Earth and some of the Moon's surface that was taken from lunar orbit by astronaut Bill Anders on December 24, 1968, during the Apollo 8 mission. (NASA)

Over the last half a billion years, there have been five mass extinctions, when the diversity of life on earth suddenly and dramatically contracted. Scientists around the world are currently monitoring the sixth extinction, predicted to be the most devastating extinction event since the one that wiped out the dinosaurs. This time around, the cataclysm is us.

In her book, The Human Age, Diane Ackerman echoes Darwin by writing, "Only moments before, in geological time, we were speechless shadows on the savanna, foragers and hunters of small game. How had we become such a planetary threat?" To this Kolbert adds, "The sixth extinction is likely to be mankind's most lasting legacy; it compels us to rethink the fundamental question of what it means to be human."

Fast-forward to some extraterrestrial wisdom on Christmas Eve, 1968. When the crew of Apollo 8, William Borman, James Lovell and William Anders, completed their fourth orbit around the moon, they emerged from the moon's dark side to see in awe the Earth rise before them. Anders took the iconic photograph that came to be called "Earthrise."

Remembering the sight of a fragile looking Earth, a very delicate looking Earth, Anders said, "I was immediately almost overcome by the thought that here we came all this way to the moon, and yet the most significant thing we're seeing is our own home planet, the Earth."

I find it profoundly moving that Kolbert's micro view of Earth is as powerful and relevant as William Ander's macro view of our same Earth from 238,855 miles (a distance of 30 earth's diameters) away. They are both witnesses of the fragility of Earth from unique vantage points.

John Bos has been writing about climate change, then the climate crisis and now the climate emergency for ten years. He is a contributing writer for Green Energy Times, Citizen Truth and is a regular "My Turn" contributor to the Greenfield Recorder in MA. Comments and questions are invited at john01370@gmail.com. ♻

Climate Crisis and the Fossil Fuel Empire

Dr. Alan K. Betts

Australia is far away, but it has some climate lessons for us. The fire season in the dry southern summer of 2019-2020 was horrifying and bush fires scorched a record 46 million acres, ten times as much as the 2020 California fires which set a new record on our west coast. The vast Siberian fires in 2020 also burnt through a comparable 49 million acres of the Russian landscape.

The dreadful face of climate change shown by Australia's wildfires in 2019 and 2020. {famvin.org).

Australia is a major coal exporter and the burning of coal, a fossil fuel, is accelerating climate change and amplifying wet and dry climate extremes. Russia is also a big exporter of fossil oil and gas. So, Australia and Russia are both responsible for a significant part of their self-destruction, as well as destruction elsewhere. Drought is again spreading across the western U.S. this spring, so watch carefully, since we too have a large fossil fuel industry driving climate change. In Australia just as the wildfire season ended, Covid-19 struck. Remarkably, the Australian government woke up and realized they should act preemptively, which they have not done with the fires. They immediately closed the Australian borders and ordered returning citizens to go into supervised quarantine. This saved the country from a Covid-19 disaster. The U.S. has 13 times the population of Australia, but the U.S. has had 1000 times the number of Covid-19 cases and 600 times the number of deaths. What a difference leadership can make - if it wakes up.

The climate issues are deeper and facing the climate crisis this decade is critical. Collectively all the fossil fuel interests and their political allies deny responsibility for climate change, saying they are not responsible for the future. The fossil fuel companies know hundreds of millions of the world's children and grandchildren will die and perhaps a third of the Earth's living species will go extinct over the next fifty years. Exxon has known this for forty years, ever since their own senior scientist, James Black, told them in 1978 how much the climate would warm from doubling CO2. He recommended they change their energy strategy within ten years. They suppressed his report and for forty years have conspired with the rest of the industry to deceive the public and bribe politicians to prevent government legislation to regulate and phase out the fossil fuels.

This fossil fuel industry conspiracy I have called the Fossil Empire. They are driven by maximizing current profit and avoiding responsibility for the costs of the accelerating climate disasters that will destroy so much. It is so cheap to bribe U.S. politicians. By a recent count, the 139 Republicans in Congress who publicly deny the science of climate change were paid a total of only $61M by the coal, oil and gas industries. For less than an average of half a million dollars each, these Republican are happy to lie in public and vote to destroy so much life on Earth. Yet the capitalist framework can easily address the climate crisis by placing a rising price on burning fossil fuels, since we have estimates of the future damage from climate change. The money raised can be used to drive a rapid transition to renewable energy.

A protester holding a sign about the climate change denial of ExxonMobil at the protest "Our Generation, Our Choice" in Washington, D.C. on November 10, 2015. (Johnny Silvercloud)

Why does the public accept this criminal conspiracy to destroy the Earth for profit? Because they too have been deceived by a second strategy. At first, the Fossil Empire just denied climate change was real, but as climate disasters grew larger, they shifted to the deflection strategy that works so well for industry. Deflection is when you convince the public that it is better to solve a challenging problem by individual action (since it is a free country), rather than by government regulation. Covertly, selling this strategy has been an immense success. Climate activists can be encouraged to discuss and argue over whether one should travel less, buy an electric car, install solar panels, eat a vegetarian diet, have fewer children or live a simpler life. The list is endless. This strategy deflects attention from what needs to be done at the societal level to the individual level, where people can either feel they are taking useful steps, or perhaps instead feel guilty. Of course, individual choices are very important, but they will not fix the huge climate crisis, which needs both national regulation and global agreements to deal with phasing out fossil fuels.

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

Keeping to 1.5°C

Cont'd from p.1

a quarter of all coal miners in the country had lost their jobs, as the coal industry collapsed. The new administration promises unemployed coal miners work in renewable energy, with the support of the United Mine Workers of America (www.bit.ly/mine-union-support).

While detractors say that the president is asking for too much money, we should be clear about the economics. Coal-burning power plants are a good example. Most of these coal-burning plants in the U.S. are getting old, and many are losing money. Recently, Greenpeace underscored this, saying that operators of U.S. coal plants had lost another $5.4 billion with competition from less expensive solar and wind power (www.bit.ly/coal-bleeding-money).

A clean environment. (Gustavo Quepón, Unsplash. www.bit.ly/Clean-environment)

Moving powerfully to renewable energy will not just employ workers. It will also save a bundle of money for American consumers, and for the very same reason that coal is in trouble.

For those who say that the sun doesn't always shine and the wind doesn't always blow, new technology that has come along makes that statement irrelevant. The cost of battery storage has been dropping astonishingly. Not only that, but new energy storage systems do not necessarily need any lithium, cobalt, or other unusual chemicals. Highview Power, for example, stores energy as liquid air, and it just got a $1 billion order for its systems in Spain (www.bit.ly/liquid-air).

As all this addresses climate change, creates jobs, and reduces the cost of energy, it also improves the environment. We might think that this last issue has not received the attention it deserves. The health costs of burning fossil fuels are not included in the price or subsidies, but they are huge. Worldwide, millions of people die every year because of air pollution. In the United States, the number is much lower, but it is still many thousands. And the healthcare costs for people who get sick from pollution is staggering. An article published by the Union of Concerned Scientists in 2008 and updated in 2016 puts the healthcare costs of particulate matter from coal-burning power plants in the U.S. at over $100 billion per year (more.bit.ly/Coal-soot-cost).

While the Biden administration indicates that it might support the use of nuclear power, which has an unsolved issue of waste and other issues, its outlook for dealing with climate change and energy seems otherwise well designed. Altogether, we might say that the Administration's plan has something positive for nearly everyone. The only people who might feel losses are those who insist on being invested in systems that make people sick, cost too much, and are environmentally destructive. ♻

The Norwich Cliff House:

Tradition Meets Affordability in a Right-Sized Modern Home

Barb and Greg Whitchurch

At the end of a small street in Norwich, VT, there is a fascinating, small home being built for a mother and her three teenage children. It is highly energy efficient, very affordable, and features all-electric appliances, plus a small pellet fireplace-style heater for radiance and ambiance.

Designed by Daniel Haedrich, Associate AIA / LEED AP, (BackTilt.com) and constructed by Ethan Cole (EarthShareConstruction.com/) it is 1280 square feet, two stories, sits atop a concrete slab, and features a very flexible, indeed adaptable, interior design and construction (more on that later!).

The Cliff House sits atop a little knoll at the end of a narrow street. (Photos: Greg Whitchurch)

> *"The owner, builder and I are all proud of this project. We consider this house to be a template for the homes we should be building: compact, in an existing town, efficient, and all-electric."*
> *- Daniel Haedrich*

The first impression is that the house blends in so well with its surroundings as to be almost part of the landscape. The rear yard is populated with about a dozen very tall gray-trunked trees and backs up against a huge bare cliff face, and the vertical pine siding is painted the same light gray as the cliffs. There will be no environmentally costly lawn. The landscaping will be permaculture-based and will consist of gravel paths, a stone patio, and wildflowers (using seeds from the Vermont Wildflower Farm (VermontWildFlowerFarm.com).

Inside, there is a kitchen living space with an island and large windows with deep sills that can be used as seating. (This seating feature is common in high-performance buildings. Since the walls are super-insulated, twelve inches in this case, the sills are deep and invite various uses.) Of course, when one invests in proper walls, one doesn't want to scrimp on the windows. As with other residential and commercial buildings in this area, the windows are triple-pane Kohltechs supplied by Loewen Window Center of VT and NH (LoewenVTNH.com/).

Adjoining the kitchen is a small bedroom. The partition wall between these two rooms contains the kitchen plumbing and electricals. This clever design allows the two rooms to be "flipped" at any time, the small bedroom could become a pass-through kitchen with the top half of the wall removed, and the larger space could be used as living space.

Likewise, there are three upstairs bedrooms for the kids, but the partition walls are wired and framed to be easily removable as the kids leave the nest. There are no closets; rather, freestanding Ikea-style wardrobes will serve. The stairway to the second floor also incorporates a bookcase built into the railing. These flexible design features make the most of the modest footprint. In fact, everything about this house is geared towards modesty, economy, efficiency and low environmental impact. To quote the architect, Daniel, "We wish to work quietly with this environment."

A refinished countertop from the owner's old house forms the bookcase top and doubles as the office and library in the second floor stair hall .

By now, most people know that gas and electric water heaters are unaffordable both financially and environmentally. But heat pump water heaters can add or remove a bit of heat from a home at awkward times. Ta Da! Enter the SanCO2 (bit.do/475-sanco2), which follows the design of traditional heat pump home heaters/coolers by placing the heat exchanger outdoors. Plus, it uses CO2 as its refrigerant for additional efficiencies.

Speaking of whole house heating and cooling systems, they've installed a cold climate heat pump (bit.do/fuj-12lzah1), especially designed for our climate. But the owner grew up with wood-fired stoves for heating and has included a fireplace-style pellet stove from Home Comfort Warehouse (https://www.homecomfortwarehouse.com/) for the ambiance of radiant, additional heat with a bright fire blazing behind its glass door. The Piazzetta SC Lia (bit.do/sc-stove) has a programmable thermostat, remote control, humidifier, and is eligible for rebate incentives.

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Efficient window in stair hall frames cliff behind the home. (Interior images: Daniel Haedrich)

To keep the outside out and the inside in, their air-sealing efforts have yielded a blower door test of 0.57 ACH50 (a Passive House level!) before the insulation and drywall were installed. The house is enrolled in Efficiency Vermont's highest tier, bit.do/evt-hph-inc, with significant financial incentives. (By the way, these incentives are so to speak,"your tax and utility dollars at work," helping people be more responsible about their energy uses.)

On an environmental and personal note, the owner of this home grew up in the house next door to it. Some of the interior features, such as countertops, have been brought over, refinished and installed in the new home. An old wood stove will be moved from its original spot next door to the patio of the new home. There is a continuity here and a wish to preserve elements of the family's history.

Many thanks to our sponsor:

Thick insulation creates deep window wells for the energy-efficient windows.

Haedrich said, "The owner, builder and I are all proud of this project. We consider this house to be a template for the homes we should be building: compact, in an existing town, efficient, and all-electric."

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

More construction specifics:

- Base: site sand, crushed rock, 8" EPS, 10mm Stego moisture/air/Radon barrier, concrete slab, laminate wood flooring.
- Walls: Pre-stained pine siding (LaValleys.com/), Pro Clima Mento membrane (Contractor says he will try a self-adhering outside membrane next time), half- inch plywood sheathing with Pro Clima Tescon Vana tape, 12 inch double-stud wall with dense-packed cellulose (CheyInsulation.com/), Intello intelligent perm membrane, sheetrock and standard paint to finish the interior.
- Intello and Mento air & moisture membranes, tapes, SanCO2 DHW: FourSevenFive.com
- Pellet stove: Home Comfort Warehouse, White River Junction, VT

So, You Want to Build a House?— How to Begin

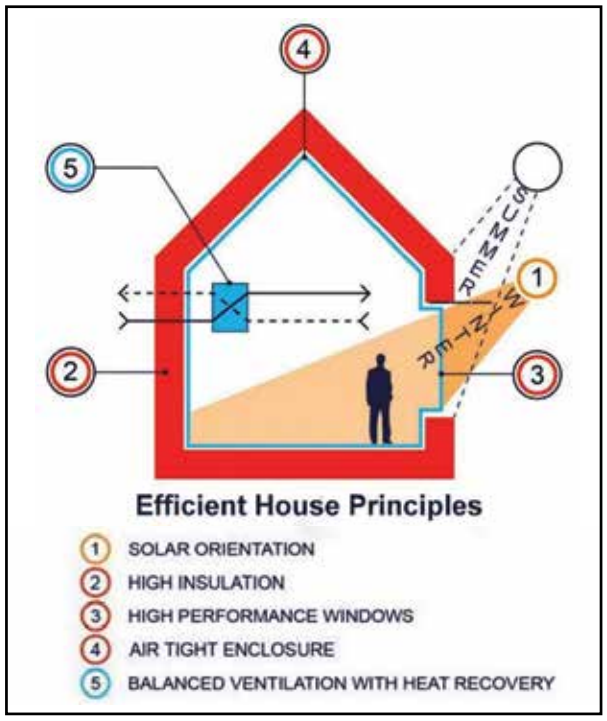
(Part 1 of 2)

Barb and Greg Whitchurch

Few enterprises in life are as exciting as designing your own home. By "exciting," we also mean stressful. We've done it three times and concluded that, to our credit, we made different mistakes each time.

Kicking off your project on the right track makes all the difference. Your willingness to deal with a few issues up front is crucial. Simply put, make sure your builder or designer is certified to build a modern home. Then, make sure they agree to follow some simple engineering principles. That's it!

Too many people limit their involvement to the appearance of the building, the floor plan, the finished surfaces, the fixtures. Pretty much anyone can give you a beautiful-looking home. But modern construction requires knowledge regarding the invisible "guts" of the house. Many people don't start wondering about some of the less visible aspects of construction until they notice high energy and maintenance bills, some irritating cold or hot areas, or some cluster flies. (Issues like mold and rot would occur later on.)



So, what's the difference between an expensive-to-run, somewhat uncomfortable house and a modern, efficient, cheap-to-run, maintenance-free house?

Well, it's NOT the cost. Both will usually cost about the same. There are a lot of things that houses used to need, like a furnace or a boiler, that aren't needed anymore in a modern, high-efficiency home. So, for example, take away the boiler and replace it with a heat pump, and you've just offset the likely high cost of triple-pane windows.

Another example is the cost of fuel. If you increase the amount of insulation around and under the foundation and in the walls and roof, you'll save a lot on fuel right away and, especially, over the long term. This will more than offset the cost of adding extra insulation.

A third example is air sealing. Serious air leaks are what happens when leaks around windows, doors, and electrical outlets, aren't done properly. This is extremely common. The inadequate sealing creates a pathway for the heat inside to escape to the outside. And that costs you. You have to use more fuel to maintain a consistent indoor temperature. Or cool it more in the summer. So, the cost of having someone spend additional time and use the correct types of sealing tape is, again, both immediately and over the long term, going to be offset by your fuel savings.

(As you may know, over the past many decades insulation wall thickness has improved from 2x4 to 2x6 to 2x8. So has air sealing improved from stuffing fiberglass around single-pane windows to actual tape application. Ongoing, stepwise progress has reduced the size, cost and fuel consumption of the machines that must make up for the design shortcomings of yesteryear. Now building science has finally achieved an engineering standard that pinpoints just how modern materials and methods have eliminated the need for huge heaters and coolers in our homes. Small, cheap, safe heat pumps can easily and evenly control our indoor temperatures without any need for fossil fuels.)

Building science

Homes are no longer just an assembly of lumber, windows, doors, insulation and fixtures. Modern homes are engineering marvels, like cars, aircraft and bridges. There are well-understood rules and methods (building science) for designing homes, and these rules are governed by standards that ensure comfort, efficiency, health, and safety. The most common serious problems in homes today are invisible once they're completed. The way to avoid these mistakes is to do energy modeling, verify the building process, test along the way, and have a rater certify it at the end. All of these processes and professional services are included when building with Passive House (PH) (www.VTPH.org) or Efficiency Vermont (bit.do/evt-hph-reb).

Simply having honest professionals is not enough. They can make honest mistakes and oversights. The building industry, like auto mechanics and the medical profession, offers continuing education in building science and new materials. Make sure your team is up-to-date by checking their certifications. If they're PH-certified, then they're qualified for all aspects of high-performance design and construction. You'd be surprised how many builders don't bother with training at all, or who allow their certifications to lapse.

Where to begin

First, contact responsible architects or builders (e.g., bit.do/een-evt or VTPH above) who use energy modeling tools and a spreadsheet to track and assess the design process. During the building process itself, make sure independent experts verify that the design plan is being followed. Finally, have the finished product certified. Many people choose the PH (bit.do/phius-cphc) or the Pretty Good House (www.prettygoodhouse.org/) route because all of these steps are included, even if the homeowner decides not to meet all the individual objectives in the end.

There are still old-school builders who claim that these safeguards are a waste of time and money. Fortunately, there are organizations, both governmental and private, that keep track of who's up-to-date in their education (e.g., bit.do/bpi-05602).

For example, constructing any modern home requires moisture management techniques that are not part of every builder's "toolbox." Mold problems have been on the rise for many years now, often caused by builders trying to build to modern standards without proper training. Amazingly, many homes are candidates for weatherization upgrades as soon as they're finished, simply because the owners didn't bother to check on their builder's accomplishments.

More than 600 complaints were filed with the Vermont Attorney General's office against contractors in a recent four-year period; and that only suggests a starting point for estimating the personal and environmental damage done through sloppy work from that sector. Vermont does not even enforce the (inadequate) building code standards currently on the books!

For 15 years, the Vermont Association of Homebuilders (www.HomeBuildersVT.com/) and many legislators have been trying to register contractors (bit.do/vt-leg-contractor), but vested business interests have lobbied with the same tired, obfuscating arguments used in the past to resist regulations for seat belts, building codes, and air pollution in order to prevent its passage (www.tinyurl.com/hcv-contractor).

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Chris Miksic, CPHC, CPHB, of Montpelier Construction, sets up a blower door air-sealing test on the Whitchurch Passive House during construction. (Greg Whitchurch)

Integrating Social Equity into Green Building (Part 2)

James Wilson

Reprinted with permission from Steven Winter Associates (SWA), Inc. blog on Oct. 12, 2020. Part 1 can be found in the April-May 2021 issue of Green Energy Times.

PRE-DESIGN PHASE

The social and environmental context can vary greatly from one project to the next. To achieve social equity goals, a well-constructed plan for all project phases must be created and tracked. And, although the measures are not generally complicated, they can be numerous. In order to promote social equity, SWA has compiled this series of blog posts that teams can refer to as a guide to help facilitate the process. The goal is to help project teams understand, identify, and incorporate social and environmental goals and strategies into projects in a holistic and integrated way.

The following outline provides an overview of steps the design team can take in evaluating projects during pre-design. Throughout, references to *Leadership in Energy and Environmental Design* (LEED) credits are cited.

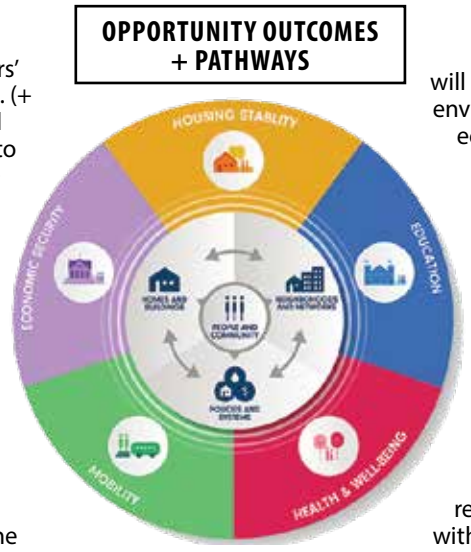
Site selection

If possible, support equitable development by selecting a site in which the economic and social fabric of the surroundings will benefit from the project (LEED Location and Transportation Credit High Priority Site and Equitable Development). Take into consideration access to public transportation and amenities for future occupants and stakeholders.

To be successful, it will be necessary to first define the project's potential "socialshed" (the radius of potential social impact) and identify all stakeholder groups that will likely be affected, directly or indirectly. Understanding the surrounding communities, and the individuals that they represent, are of paramount importance to evaluating strategies for social equity.

Once a site has been selected, perform a site assessment that includes investigation of all aspects related to how people might use the site and how their health and wellbeing may be affected. Consider views, transit connections, sources of pollution, long-term goals of the surrounding community, accessibility compliance, universal design, recreational opportunities, etc. (LEED Sustainable Sites Credit Site Assessment; LEED Universal Design Pilot Credit).

Depending on the scope of the project, it may make sense to use Geographic Information System (GIS) data to gain a greater contextual understanding. Overlaying both social demographic and environmental data onto the map of the surrounding area can reveal where issues and opportunities exist. Examples include a disparity in access to public transit or green space, a concentration of air quality-related health issues in communities disproportionately burdened by pollution, or inaccessible public rights-of-way that limit access for people with disabilities to goods and services. The team can start with the EPA's EJSCREEN: Environmental Justice Screening and Mapping Tool or Enterprise Community Partners' Opportunity360 Measure Tool. (+ ESRI: "Mapping Environmental Racism"). This is also the time to research applicable accessible design and construction requirements that apply to the built environment. And, to enhance inclusivity, assess the project for how well it meets the goals of Universal Design.



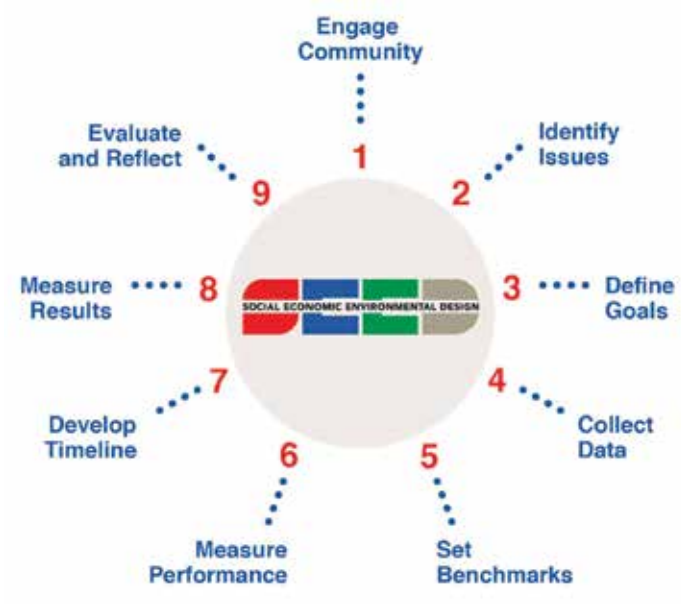
People and Community (www.bit.ly/Enterprise-community)

Project Goals

Integrate the findings and research gathered during assessment into the early sustainability and wellness design charrettes so that, as the team is establishing goals for the project's performance, sustainability and accessibility, they have the opportunity to consider the social equity aspects of each.

This is the time to use the LEED Project Team Checklist for Social Impact to help stimulate and focus discussion of the project's potential effects on social equity. Refer to the requirements of the LEED Inclusive Design pilot credit for how to incorporate socially inclusive communities.

Use community engagement strategies to gather further information and provide stakeholders the opportunity to participate in the planning of a project that will impact their environment. Project teams not experienced with community engagement might partner with local community groups with expertise in the process, established relationships with stakeholder groups, and a communication infrastructure already in place. Developing trust relationships with the communities affected is critical to attaining socially equitable design. The Opportunity360 Community Engagement Toolkit cited above is a good place to start.



SEED Diagram (www.bit.ly/Seed-diagram)

Develop a "Project Mission Statement" that clearly describes who and what the project is planned for. This will help to unify, focus, and motivate the team's efforts. Include this mission statement as part of a larger equity plan—a living document used to outline specific social equity goals, the strategies and design principles used to achieve those goals, and the mechanisms used to measure the impact of those strategies. The Social Economic Environmental Design (SEED) Evaluator can help teams develop an effective equity plan for their projects (Social Equity within the Community Pilot Credit).

Strive to meet the eight goals of Universal Design, which can serve as a guide to ensuring that the project positively affects as diverse a population as possible by helping to improve human performance, health and wellness, and social participation.

The specific social equity criteria developed for the project should also be incorporated into the Owner's Programming Requirements and Basis of Design document. It is important to make social equity goals explicit and intentional to help the team remain accountable.

This collection of documents will help the team to shape, monitor, and measure the impacts of social equity goals throughout the process and should be referred to regularly. Assigning a specific member of the project team the responsibility of championing social equity goals through each phase will help to keep the team on track toward achieving those goals.

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

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

Celebrating the Spring and Autumn Equihume

By Nate Gusakov

Condensation on a window. (Ozgu Ozden, https://bit.ly/3kytUIV)

The practice of marking and celebrating the spring and fall equinoxes is a human custom that is older than Stonehenge. The two points of the year when day is equal to night (equi-nox, equal-night) are still noted by billions of people, all around the globe (this year, March 20th and September 22nd). Somewhat less common is the practice of marking the equi-hume (yes, I just made that word up) – the point in the year at which the average daily relative humidity inside your house is equal to the average daily relative humidity outside. This is a moment that should be celebrated, as it represents a time of building science peace, during which there is very little risk of condensation anywhere in the building assembly of your house.

Here in the northeast U.S., there is a huge seasonal variation in average relative humidity. During the winter months, the air is cold, often well below freezing and even below 0°F. By the laws of physics, this air is much drier than the warm air inside our homes. Because the warmer inside air can hold more moisture than the cooler outside air, there exists a vapor pressure differential that causes interior moisture to drive against outside surfaces. If these surfaces are cold enough, we get that vapor condensing into liquid water on them. By contrast in the summer, the outside air generally carries more humidity than cooler inside air (either cooled by shade or by air conditioning, in which case it is much drier than the outside air). In this situation (which is much more common in the air-conditioned southern states), a vapor pressure differential is formed with vapor driving inward. If this vapor meets a cool enough interior surface, voila – condensation!

The picture shows a familiar sight. Condensation on the inside of a window pane during a cold winter day. Change the scene to a 95°F muggy day in the southeastern U.S. and take the picture from the inside of a house that's air-conditioned to 55° and dry, and the condensation would be on the outside of the window pane. On equihume days, well, no need to worry in either direction.

As you can see, the progression of seasons in our climate subjects a house to near constant vapor pressure drives, potentially from both directions, leading to condensation risks that have to be addressed with proper design and detailing of the thermal envelope. The proper protection against condensation is a sufficient and consistent thermal envelope with adequate insulation on the correct side of a consistent and continuous air barrier. Each spring and fall however, regardless of the state of the building envelope, every house gets to enjoy the equihume and a respite from the risks of condensation in the building structure.

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

Efficiency Vermont's Efficiency Excellence Network (EEN) Contractor Spotlight:

Dick Soule Refrigeration of Enosburg Falls, VT

Interview with Chelsey Lawyer, CEO, and Micah Murray, Operations Manager
Efficiency Vermont staff

DICK SOULE REFRIGERATION
VERMONT'S REFRIGERATION SPECIALISTS

Dick Soule Refrigeration has been servicing dairy and commercial businesses in New England and Eastern New York since 1967. The company recently received an Energy Leadership Award from Efficiency Vermont.

Can you tell us a little about the company and its recent history?

CL: The company has two names: R. Soule and Sons, and Dick Soule Refrigeration, which is how most people know us. In 2017, Nathan Hale purchased the company from Richard Soule III after working here for many years. I've been with the company since October 2019. I support Nathan with day-to-day operations, strategic planning, and budgeting.

Dick Soule Refrigeration specializes in both agricultural and commercial work. In fact, we've been able to incorporate a lot of our commercial work into the agriculture world. We want to be a leader in both markets.

MM: We are using the evolution of commercial technology to apply to agriculture. We have pretty open conversations with our farmers and suggest ways to help them run the farms more efficiently. They're looking to cool their milk fast and keep it cool. We can do a new install or make custom parts to swap out in existing systems and make them run more efficiently.

Where does the emphasis on efficiency come from?

CL: Nathan Hale is very focused on R&D projects. He lives and breathes refrigeration. He loves thinking about how we can do it better. Because of this, we now install a lot of custom-built equipment and use our own Dick Soule custom-built controls on many projects. That means we're able to control refrigeration systems better and more efficiently. We are able to really dial in on the systems.

MM: Yes, and these control boxes are always data logging. So, we can see [patterns in] what's going on with the equipment, and we can adjust it remotely. That's a huge advantage for both us and the farmers, as we don't have to travel to the site. For example, we can modulate the glycol pump and make adjustments to our head pressure settings (controlling how much liquid refrigerant or glycol is flowing through the system) remotely. We've found lowering the head pressure settings can make the system function 15–20% more efficiently.

Controls also affect the washing systems for milk tanks and milking parlors. We can make an adjustment remotely, and the farmer tells us what effect it's having.

CL: Farmers also get a lot of bang for their buck by repurposing water using free heaters, which is fairly standard in the agricultural world now.

How has the pandemic affected your business?

CL: It changed our internal precautionary measures. We make sure the trucks are cleaned and wiped down, and we keep the same drivers in the same trucks as much as possible. We have two teams, the installation team and the service team, who come in at 6:00 am and 7:00 am respectively, which keeps them segregated from each other. Our team members also always mask up when they go to customer locations. I am in the office full time, but we have limited staff in the office—just myself, an inventory specialist, and our accountant once a week. Honestly, we have been incredibly lucky.

You never had to shut down?

CL: We really couldn't shut down. We have a 24/7 paging service, and people have emergencies regardless of the pandemic. Farmers couldn't stop milking, which means our service team needed to be there to support them. If their cooling goes down for their milk, they need service immediately to ensure that milk temperature remains within the regulatory standards, or they will have to dump it.

We also service restaurants, food manufacturing plants, and convenience stores, which, for the most part, remained open as well. Some customers were maybe more cautious, and deferred doing some work, but service work was still imperative. If our commercial customers have a cooler or freezer go down, they too are at risk of losing costly product. We need to get there quickly.

Can you tell us how Efficiency Vermont and the EEN are helpful for the company?

CL: We often reach out to Efficiency Vermont for help calculating return on investments for customers, figuring out "How long before you pay off this energy-efficiency investment?"

Right now, we are working on doing another rack system for a store. We think, "What are ways we can build on the last work we did? How do we continue to improve this product for our customer?" Efficiency Vermont can be a sounding board for those questions. Efficiency Vermont is also invaluable for its financial support, having incentives for products and projects that helps us help our customers. We completed a large CO2 rack installation and had members of the Efficiency Vermont team supporting that project.♻

Chelsey Lawyer is CEO of Dick Soule Refrigeration. Micah Murray is Operations Manager of Dick Soule Refrigeration. Courtesy images.

The Hippies Had It Right

Larry Plesent

Young people near the Woodstock music festival in August 1969. (Wikipedia)

The polls are closed, the results are in, and four out of five of my IPA-drinking friends agree. The hippies had it right. And if we had continued on their track, western civilization would have evolved much differently over the past fifty years. Here's one (formerly dirty) hippy's perspective.

Tread lightly on the Earth, she is all we've got. Hippies came in all shapes, sizes and colors, and it is not accurate to paint all with the same Day-Glo brush. But a few basic principles were almost universally shared by people in the alternative movements. One was that resources of all types are precious and are not to be squandered. Use what you need, share what you have, and please clean up your own mess. A dislike of the hoarding of resources (allowing the concept of a billionaire to even exist) and a profound uncomfortableness in having much more than your neighbors has characterized a kind of lefty tribal egalitarianism that simultaneously promoted individual artistic expression and letting your friends borrow your car and once again return it on empty. Had we continued in this vein, we would have built fewer roads, fewer houses, fewer vehicles, had more alternative energy, longer vacations and definitely fewer barbers.

People are people, so cut the crap. My profound lack of respect for political correctness has often been misinterpreted. When you come of age on a commune watching women hold hands walking across the knoll, there is no emotional impact involved seeing people act a little differently than what might sometimes be considered "normal behavior." March when you feel you need to but recognize that each of us is unique in creation, and there really is no such thing as "normal." Like many Vermonters' viewpoints, if you are comfortable in your own skin, others will accept you for the good person you are regardless of how you dress, cut your hair or whose hand you hold. But don't get all uptight if someone questions your trip. It's also their right to give you a poke to see how genuine your really are about what you do and how you express yourself.

Question authority and every social and political meme along the way. The hippies knew that ancient indigenous tribal cultures (and hard-working New England rural cultures) knew a thing or three about being human that our mostly suburban upbringings failed to teach. Starting with the premise that everything they (parents, school, church, television and the Establishment) told us was probably wrong, an atmosphere of playful social experimentation began to express itself. We tried a lot of dumb things that didn't really work. But along the way we had some successes too. These days the commune experiments would be called pilot projects or seeking proof of concept. I do not consider these alternative social structures to have been complete failures, just because the majority of them collapsed within a decade or two. This is the stage upon which the movement for the basic rights of all people and living things to follow their natural life courses was played out. It was and is a movement that has profoundly changed societies around the planet.

No fighting, no biting. People will differ on their politics, but my politics are rooted in the basic principle that bullies suck. It was never considered appropriate to fight violence with violence. However, when the women, children and older folks were threatened, hippy folk stood right up, usually in highly creative ways. For example, having 30 longhairs pop up out of the bushes yelling like banshees and taking pictures of the troublemakers as the local State Trooper walked toward them shining a very bright flashlight put an end to that type of trouble mighty quick!

Eight years of commune life taught me a lot about being a person, an adult, and a man in this place and time we call America. And when I left, it was more to escape the merciless grinding poverty of the lifestyle than the lifestyle itself. Forget beer money, all I wanted was a handful of 16-penny nails! And like many an artist, craftsperson and small business founder and owner that finally grew up, I swore to remember the lessons from those days and to incorporate them into my business and human relationships. During the ensuing 50 years, multiplied through over three hundred and fifty thousand Vermont transplants, this attitude has become a big part of what makes Vermont the special and unique place it continues to be.

Soap for the people!

Larry Plesent is a writer, philosopher and founder of the Vermont Soap Company dedicated to replacing yucky stuff with yummy stuff for all the girls and boys who care. Thanks for listening. Learn more at www.vermontsoap.com and www.reactivebody.org.♻

Elmore Roots' Permaculture Know-How

What We are Meant to Do

David Fried

There is a duck sitting, floating in the river under some leafy branches, so I can barely see him.

The camel stands up tall and watches us as we walk out from the rocky path. I am thirsty from my hike, but I do not think he is very thirsty. The camel is meant to go long distances over sand and over time with very few stops for water.

I have been getting up every day at the first hint of light. I have rows of cuttings to make, so we can have more very hardy berry bushes and flowering shrubs that Vermonters can grow in their yards. How else will the best undiscovered black currant varieties and the little-known basket willows be here for future generations?

I take my sharp pruners to my best and most vigorous plants and cut some stems back a little. I write with a wax pencil the variety name onto a plastic label and carry the bundle down to our cutting beds the crew has prepared with deep, rich weed-free earth. Kneeling into the soft mud, I take each cutting and plunge it gently but deeply into the earth, pushing further and further. Slowly, I ease it in until only one or two buds are showing above the ground. There are rows of them now after a springtime of doing this. I visit every few days to see if the natural weather with some sun and some rain, some cool and some warm, will be just what they needed to do what they were meant to do. Grow.

Some early summer days are so hot, but then the clouds come in and soften the effect. My friend Bruce used to play only one song on the piano as a boy, and this was the Joni Mitchell song "Both Sides Now": "I've looked at clouds from both sides now, from up and down, and still somehow, it's cloud illusions I recall, I really don't know clouds, at all." When

Photo by Joyce Dutka

working outside on a very hot day with the sun in my eyes, I am thrilled when the clouds do what they are meant to do, balance the heat and brightness with their shade, sending all kinds of contrasts and shadows about the earth.

Whether we are running for mayor, running for fitness, or running to help someone, we are inspired by our vision of how to make the world a little better. Some of us plant a garden. Some of us keep planting trees. Some of us call a friend to see how they are doing. Some volunteer to visit older people. I have a practice lately of not going to sleep until I write a poem or email to a few friends or family I know can use a kind word, hoping to bring a smile in the night or the morning.

One of my teachers said, "How does war start in the world? Someone on an island off the coast of Java yells at their child. How does peace begin in the world? Someone on a street near you wakes up and says to their kid or their partner, 'It is so wonderful to be in the world with you.'" Sometimes we have the strength and the gift to be able to give over one good word to someone. Maybe this is what we are meant to do.

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

Net-Zero Air BnB – Cont'd from p.23

them out of reach for many Vermonters. Whatever can be done to reduce complexity should help bring down the cost."

The model that Taco is releasing in the near future will feature a sleek, Euro-looking exterior. Otherwise, the beta test unit at the farmhouse is nearly identical to the final system. Like many modern appliances, the system can be controlled through a mobile app.

"This is the Tesla of the residential HVAC world," said Chaffee. "In that respect, it's similar to a geothermal system, though without the expense and disturbance of drilling or trenching a ground loop. It will appeal to homeowners who're interested in minimizing their environmental impact and eliminating fossil fuel consumption. It will also be of interest to consumers who understand the comfort advantages of a water-based hydronic heating and cooling system."

Several roads to comfort

In addition to providing domestic hot water, the beauty of the new Taco heat pump system is the ability to provide chilled and hot water to different radiation components. Matthew was adamant about providing in-floor radiant heat for the guests at the Airbnb, and took it upon himself to install radiant tubing below the floor on the ground level of the house.

Before the retrofit, the upstairs of the house had been extremely uncomfortable during the summer. In each of the bedrooms, Lloyd Plumbing & Heating installed fan coil units for heating and air conditioning. According to Matthew and Roux, the home is now far more comfortable in the summer.

"Not counting the domestic hot water load, the home needs 60,000 BTUs of heating capacity," said Lloyd. "The heat pump is rated for 48,000 BTUs. In addition to replacing the old oil boiler, the new heat pump has also replaced the existing propane water heater. Even when the house is full of guests, there has always been ample hot water for showers."

Renewable backup heat

Before deciding to install the heat pump, Matthew and Roux had considered the use of a wood pellet boiler. They liked the concept of using a renewable solid fuel so much that they decided to install one as a source of backup heat, though not necessary in most residential applications.

"Using a backup pellet boiler allows us to remain 100% renewable," said Matthew. Working with Andy Boutin of Pellergy LLC, Lloyd Plumbing and Heating suggested a Pellergy Alpha A60.

"Matthew's boiler has a 52,000 BTU/h output and runs at 86% sustained efficiency," said Boutin, general manager at Pellergy. "He can purchase locally-sourced bulk pellets that are delivered directly to his bin."

Comfort and rebates

"The heat pump and pellet boiler combined with radiant floors and fan coils made for an unbeatable combination for achieving the homeowner's net-zero energy goal," said Lloyd. "We haven't received a single complaint. Comfort levels inside have been vastly improved."

Matthew received a $6,000 rebate for installation of the pellet boiler, $3,000 from Efficiency Vermont and $3,000 from the Vermont Clean Energy Development Fund. Installation of the air-to-water heat pump would have qualified for an additional $4,000, had it not been a beta test unit.

The Taco System M outdoor unit is sleek and weatherproof.

The Pellergy Alpha A60 pellet boiler, installed by Lloyd Plumbing & Heating provides backup heat to the property.

"This is new technology," continued Lloyd. "It creates an opportunity for homeowners to increase their sustainability in a cool climate. As a fully-contained package, it's ideal for converting from a fossil fuel furnace. I think it could help us break into the air-to-water heat pump market. That's something we've been looking forward to."

Learn more about Taco Comfort Solutions at tacocomfort.com.

Dan Vastyan is PR director and writer for Common Ground, a trade communications firm based in Manheim, PA. ♻

RESOURCES

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

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

American Council for an Energy-Efficient Economy: aceee.org

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

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

Carbon Tax: carbontax.org

Clean Energy NH: www.cleanenergynh.org/

CO2.Earth: See emissions harms, scientific advice, and pathways to follow. www.co2.earth

Consumer Guide to Home Energy Savings, Heating, Appliances, Refrigerator Guide, Building Envelope, Driving: http://aceee.org/consumer

Dept. Public Svc. (CEDF): publicservice.VT.gov/energy/ee_cleanenergyfund.html

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

Efficiency VT: A must-go-to site for immeasurable amounts of info. **www.efficiencyvermont.com**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org

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

SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

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

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

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

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

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

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

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

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

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

Sustainable Forestry

Cont'd from p. 16

Dr. Kosiba also made the interesting statement, "I do wish that there was more of a focus from the public on the value of local wood for heat and materials as there is for local food."

I might sum up my position on biomass by pointing out that it is a complicated issue. I would not want to use biomass for new facilities that generate electricity exclusively, and I believe that clear-cutting forests for fuel is not a solution, but I would encourage people to use local wood or locally produced wood pellets to heat their homes. Most of all, I would stress a need to engage in sustainable forestry, tending all forests in the state, not to preserve them in their current state, which may be unhealthy or unsustainable, but to keep them in best possible health.

Please watch for more about the controversial issues surrounding biomass in the next issue of *Green Energy Times*.

This is a personal opinion piece by George Harvey, and is not necessarily the opinion of Green Energy Times. ♻

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GUIDE TO ADVERTISERS

How to Decontaminate Your Recycling Bin

Cassandra Hemenway

Mile End Residents (Flickr)

Despite what you may have heard in the national news over the last few years, the recycling industry is alive and well, catering to growing market demands for recycled content products and creating ever more domestic outlets. However, in order to do that, we have to reduce and eliminate contamination in the recycling bin.

Contamination begins at the curb, and it refers to anything that does not belong in your recycling bin. For the most part, the U.S. has invested in single sort technology, where consumers place all recyclables in one bin without sorting. Those materials later get sorted at a materials recovery facility (MRF). When you toss your wine bottle and cereal boxes into a recycling bin, someone down the line sorts through it by hand on a conveyor belt, pulling out the obvious things that don't belong there. Those materials then go through a mechanical sorting process, using magnets, blowers and other Willy Wonka-esque magic to separate your water bottles from your magazines.

Follow these steps to contribute to a clean recycling stream:

1. Get a list of recyclable materials in your area and keep it visible so you can easily refer to it. If it's not on the list, it doesn't belong in the bin. There's no gray area.

2. Vermont has a mandatory recycling law that requires six categories of materials be recycled.

- glass
- rigid plastics (yogurt cups or plastic packaging, as opposed plastic films and bags)
- corrugated cardboard (not waxed)
- paper
- steel (food-grade cans)
- aluminum (cans, pie pans, aluminum foil if clean, dry and balled up to the size of a tennis ball or larger).

3. These materials are common throughout New England, but details vary by region. I cannot stress the importance of finding out the list in your own region.

- **Know the rules:** Both humans and machinery sort materials once they reach the MRF. A few simple rules make the whole system work:
- **Rinse food containers.** No need to sterilize, but any container that has had food in it should be empty, rinsed and dry.
- **Know the 2 by 2 rule.** Anything smaller than 2 inches by 2 inches or larger than 2 feet x 2 feet cannot go into your blue bin. Small items fall between the cracks at the MRF, and the larger items are too large for efficient sorting on the conveyor belt.
- **No tanglers**. Tanglers like plastic bags, textiles and garden hoses cause the MRF to shut down for an hour or more at a time because they tangle up machinery. Imagine the loss of time and money involved in shutting down a factory for a full hour every day, plus the dangerous job of having to climb inside the sorting machine to pull out someone's tee-shirt and Walmart bag.

Sorting recyclables at a recycling center in Westboro, Massachusetts. Image: Massachusetts Dept of Environmental Protection (Flickr)

- **(Don't) follow the numbers.** Just because you see a chasing arrow with a number inside does not mean it's recyclable. Check local guidelines. Think of frozen food bags or Styrofoam – neither is recyclable in your blue bin, but both feature a recycling symbol.
- **Recycling is a business.** Blue bin recyclables are the raw materials that eventually get remanufactured into new products. Nobody's going to sort your cardboard and wine bottles if there isn't an economic incentive. In order to keep recycling viable, the economics have to work. In order for the economics to work, recyclables need to be free of contamination (see #1).
- **Buy recycled content when possible.** Contribute to making recycling work by buying products made from post-consumer recycled content.

4. Re-use or opt out. Recycling is better than landfilling, but it's not as good as not producing waste in the first place. The best solution is to buy less, use less, and reuse what you have when possible. A full 30% of landfilled materials in Vermont consists of single-use disposables that cannot be recycled. As a first step, consider giving up anything disposable in favor of something reusable; or buy second hand and avoid packaging.

City of St. Petersburg (Flickr)

Finally, if you find yourself stuck with an over-packaged product, or materials that don't have a good disposal option, reach out to the retailer or manufacturer and let them know how you feel about it. Ultimately, the best way to decrease contamination in recycling is to decrease the amount of non-recyclable materials coming at us through packaging and disposables. Please note that this article should not replace your local recycling guidelines. Check with your regional Solid Waste Management organization to get the most up- to-date information for your area.

Cassandra Hemenway is the Outreach and Education Manager at the Central Vermont Solid Waste Management District. ♻

Want to Build a House? – Cont'd from p. 30

Cost considerations

Now, with the climate crisis hard upon us, state and federal governments are paying homeowners to build energy-efficient homes. So, for example, any extra cost of the verification process is covered by Efficiency Vermont's incentives which encourage efficient construction (bit.do/evt-hph-reb and bit.do/evt-reb-res). Remember, at one time double-paned windows were considered a wasteful "extra cost." In fact, many of the important comfort and energy features of your current home were once considered "extra cost." Plus, the resale value of a certified, high-efficiency home, or as collateral for a home equity loan, more than compensates for any so-called extra cost.

We're encouraging you to avoid building a home that will soon be considered to have "missed the boat." Once built, these failings will be so buried within the construction that they cannot be corrected. Your comfort and pocketbook will suffer.

Here are some questions to ask your team: Have you built a house which is certified Passive House? A LEED-certified home? Or perhaps simply Energy Star certified? What's your best Home Energy Rating System (HERS) rating? Your best air tightness measurement? Do you test for air tightness periodically during the building process? Qualified professionals will back up their yes answers with proof.

In Part 2 of this article (next issue) we will cover affordability, how to get the specific features you want for your home, as well as the needs of do-it-yourselfers. In the meantime, visit http://bit.do/mec-wnm.

Note: Although this article is Vermont-specific, all states have similar programs, incentives and agencies, as well as many qualified and certified professionals. See pages 14-15 in any issue of G.E.T. *for more info.*

The Whitchurches are owners of a net-zero Passive House in Middlesex, Vermont and are Board members of Vermont Passive House https://PassiveHouseAccelerator.com. ♻

A Lawn You Can Feel Good About

Jessie Haas

Your lawn: green oasis or something you feel vaguely guilty about? Many people these days think that lawns should be a thing of the past. The trouble is, they actually are. We humans evolved on the African savannah; it's quite natural for us to enjoy grassy vistas dotted with trees. Vast greenswards also signal status. They were a luxury affordable only for the landed aristocracy. What says 'I'm very rich' more clearly than several acres dedicated to clipped grass that's not feeding anything, animal or human? Back then, lawns required the labor of a large number of servants or peasant farmers to maintain. These days, the environment bears the price, as gas-powered lawn equipment belches pollution and chemical fertilizers, insecticides, and herbicides poison the air, water, and soil.

Still, the rich of an earlier day were certainly on to something. A lawn can create a very peaceful feeling. It provides a space for play and picnics. Clipped grass makes it more difficult for ticks to transfer from stem to human leg. Culturally, it simply feels right, and some homeowner's associations actually require lawns. So, what's an environmentally-conscious lawn-lover to do?

AdobeStock images_410699120

First, decide what's a minimum amount of lawn that will make you happy. Unless you are a parent to a whole soccer team, likely you don't need several acres of lawn. Look at the games and activities you do enjoy on your own ground, and center your lawn on an area that accommodates that.

Choose grasses that need little mowing, such as low-growing fescues or buffalo grass. If the grass doesn't grow tall, you may never need to mow it. Maintain that reduced lawn area with electric equipment. Electric lawn mowers and trimmers are quiet, emission-free, and increasingly affordable. The Spruce gives high marks to two mowers under $170, and three more under $500. Some states, such as Vermont even offer rebates to get you to switch from gas-powered machines. Robot lawnmowers are another good option for some people. (see page 39 for more information)

Robot lawnmowers keep emissions to zero, ticks at bay with time for gardening for this homeowner. (N.R. Mallery)

Say no to non-organic lawn chemicals and fertilizers. A lawn is an area of low biodiversity already, so it's important not to reduce it further by killing soil microorganisms and insects. Remember, the fewer bugs, the fewer birds. If there's a plant or pest you feel you simply must control, find an organic way to do it. An excellent reference for all things lawn is Paul Tukey's book, The Organic Lawncare Manual.

Having narrowed your lawn, fill in the edges around it with native plantings of trees, shrubs, and flowering perennials. Native is best, because plants, insects, and birds evolve together. It's one of the astonishing beauties of biodiversity that flowers and mouth-parts can match so perfectly. In fact, they need to match, or a flower's nectar is simply unavailable to the creatures who evolved to feed on it. Create layered native edges to your lawn, with varying heights of plants from trees all the way down to ground-cover. Biodiversity loves edges, and yours can be as beautiful as a laden buffet table to local wildlife. Remember, biodiversity isn't some frill; it's the whole deal, on which life on Earth depends.

What about paths, furniture, and other garden elements? Apply some of the same rules you would to home furnishing. Avoid using conventional concrete; the manufacturing of cement emits large amounts of greenhouse gases. Use alternative cements instead, such as hempcrete, or carbon-sequestering concrete. Cut-stone pavers, while natural, embody a high level of greenhouse gases due to cutting and transportation emissions. Boardwalk or recycled-content unit pavers are a better choice. In general, permeable paths and surfaces are best for the watershed, so consider gravel, or aggregates recycled from your site, perhaps embedded in a grid system. The grid keeps the gravel in place, while allowing water to be absorbed. Avoid tropical hardwood lawn furnishings unless they have a certification from the Forest Stewardship Council. Choose local woods, recycled plastic, or bamboo.

With a little thought, you can create a lawn that makes you feel peaceful, not guilty, and one that's a pleasure to care for.

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

Jessie Haas has written more than forty books. She lives in an off-grid cabin in Westminster, VT for 36 years. ♻

The E-Lawn Care Movement Ramps Up in Vermont

Steven Wisbaum

A recent DOT- Federal Highway Administration analysis (https://bit.ly/2Sbv7xD) estimated that about 5.5 million gallons of gasoline are burned every year by lawn care equipment in Vermont. Since burning a gallon of gas emits around 20# of CO_2, that represents 5,500 tons of CO_2 released into the atmosphere.

However, advancements in lithium-ion battery technology over the past decade have enabled electric lawn care equipment to become a cost-effective alternative for most residential and commercial applications, and there are now lots of high-quality brands and models to choose from, including robotic mowers.

This is all welcome news to Vermonters who want to reduce their use of fossil fuels and greenhouse gas emissions. Two bonuses of e-lawn care are quieter operation and the absence of tail-pipe emissions from all e-lawn care equipment. It is also a lot more convenient because there is no transporting and storing gas. It is a lot less expensive to operate because electricity costs less than gas. And there are minimal maintenance and repair costs. According to Consumer Reports, the performance of residential e-lawn care tools are on par and often exceed gas-driven versions.

Gravely's new Pro-Turn Z-turn mower. (Gravely.com)

Vermonters are embracing this change. There were just a few commercial battery-electric lawn mowers operating in 2016 by two upstart lawn care companies. Five years later there are more than 50 being operated by at least seven lawn care contractors, but there are more than that. Some farms, a homeowner's association, the Vermont Department of Forestry Parks and Recreation, the City of Burlington, and the University of Vermont are all using them. There are also now thousands of electric walk-behind mowers and such other lawn tools as string trimmers, leaf blowers, and chain saws being used by homeowners and renters across the state. Sales have been so brisk that many stores are having trouble keeping them in stock.

Although e-lawn care equipment are often more expensive to buy than similar conventional products, all seventeen Vermont electric utilities now offer mail-in rebates for e-mowers and other lawn tools under Vermont's Tier III Renewable Energy Standard. The incentives for commercial e-mowers range from $1,000 (e.g. VT Electric Co-op, Washington Electric Co-op, Stowe Electric), to $2,500 (GMP), and $3,500 (Burlington Electric Department). Depending on the utility, incentives for residential walk-behind mowers range from $50 to $100, and incentives for chore tools are generally around $25, with GMP offering an extra "bundle" incentive worth $50 when three tools are purchased. In the past two years the Burlington Electric Department has issued close to three hundred $100 incentives for residential e-mowers, making it one of their most popular incentives ever offered.

Robomow® robotic RS630 mower (usa.robomow.com)

Because the use of e-lawn care equipment is still the exception rather than the rule, the Mow Electric! campaign and website was launched on Earth Day 2021 to both encourage and support the wider adoption of e-lawn care equipment. The website has links to all the Vermont utility incentives and a list of all the residential and commercial e-mowers and yard tools currently available with prices. It also has key specifications and links to the manufacturers' websites, and a list of equipment vendors. There are links to on-line product review videos and user testimonials, along with a Neighbor-to-Neighbor equipment demo network. Finally, it has a directory of e-lawn care contractors throughout the state.

The website also has resources to support grass-roots Mow Electric! advocacy activities. These resources include articles about the economic and environmental benefits of e-lawn care equipment, interactive CO_2 Emissions and Life-cycle Cost Comparison tools, and a marketing survey designed to demonstrate the demand e-lawn care services to contractors around the state.

We invite you to join the Mow Electric! Movement. The web site is mowelectric.org.

Steven Wisbaum is the founder of the Mow Electric! Campaign. ♻

Mowing with the Ryobi Z-turn mower in Charlotte, VT. (The Mow Electric! Campaign)

Rachael with her EGO E-mower in Charlotte, VT. (The Mow Electric! Campaign)