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TAMING SUMMER'S UTILITY BILL

Rising Utility Bills with Surging Temperatures, Costs and Demand

Dennis Stinson

Summer 2022 promises to be particularly challenging as it relates to America's home energy costs due to a confluence of three events – rising temperatures, costs and demand – resulting in homeowners facing an intensified fight to keep bills at bay.

A young man is surprised at a high utility bill. Summer energy demands with increasing costs are a burden for many. (AdobeStock/211454535/Damir Khabirov)

Scientific data consistently supports the fact that temperatures are climbing due to climate change. The National Weather Service predicts hotter-than-average conditions across most of the country this summer. Further, 2022 brought the earth's fifth warmest April since global record-keeping began in 1880, according to the National Centers for Environmental Information. A recent United Nations Report (2022), the Intergovernmental Panel on Climate Change, indicated that harmful carbon emissions from 2010-2019 have never been higher in history, and that it's "now or never" if we want to limit global warming.

Second, homeowners are experiencing a "rate shock" as the global energy crisis drives up prices with energy costs up 25.6% year over year, according to the Consumer Price Index. Natural gas prices have been rising since mid-2020, and then surged even more after Russia invaded Ukraine in February which contributed to chaos in the market as Russia is a major gas and oil supplier.

Lastly, there is surging demand due to our post-pandemic "hybrid home" dynamic, i.e., workers working at least part-time from home. Studies support this trend with 83% of

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Winning the Energy War

Carl Pope

As we approach the fifth month of the Russian attack on the Ukraine, and expectations of a long struggle rise, it's ever more important for governments (and society, including philanthropy) to realize that we must simultaneously pursue short term opportunities and longer-term imperatives on both the diplomatic-and-military and the energy-and-climate fronts of this struggle.

On the military-and-diplomatic theater the west has done a good job of juggling short- and longer-term tactical challenges. The West has rushed military aid to Ukraine's armies, sanctioned Russia's banks, cut off its coal and moved to embargo oil exports, while longer range Germany has accepted a much more vigorous military role for itself, Finland and Sweden are moving to join NATO and already have new security arrangements with Great Britain.

On the energy climate front, long term energy and climate objectives have been reiterated in both Europe and the US. There has been sustained rhetoric about accelerating renewables, electrifying transportation and decarbonizing sooner than 2050

On the short-term energy front, however, there is so far only an unrealistic pursuit of substitute oil and gas to replace Russian sources. Russia historically exported over 8 million barrels of oil a day. If Europe were to join the U.S. embargo IEA estimates that Russia might lose markets for as much as three thousand barrels per day. (The rest would and already is making its way to countries outside the embargo.) There is no plausible source for even three thousand barrels per

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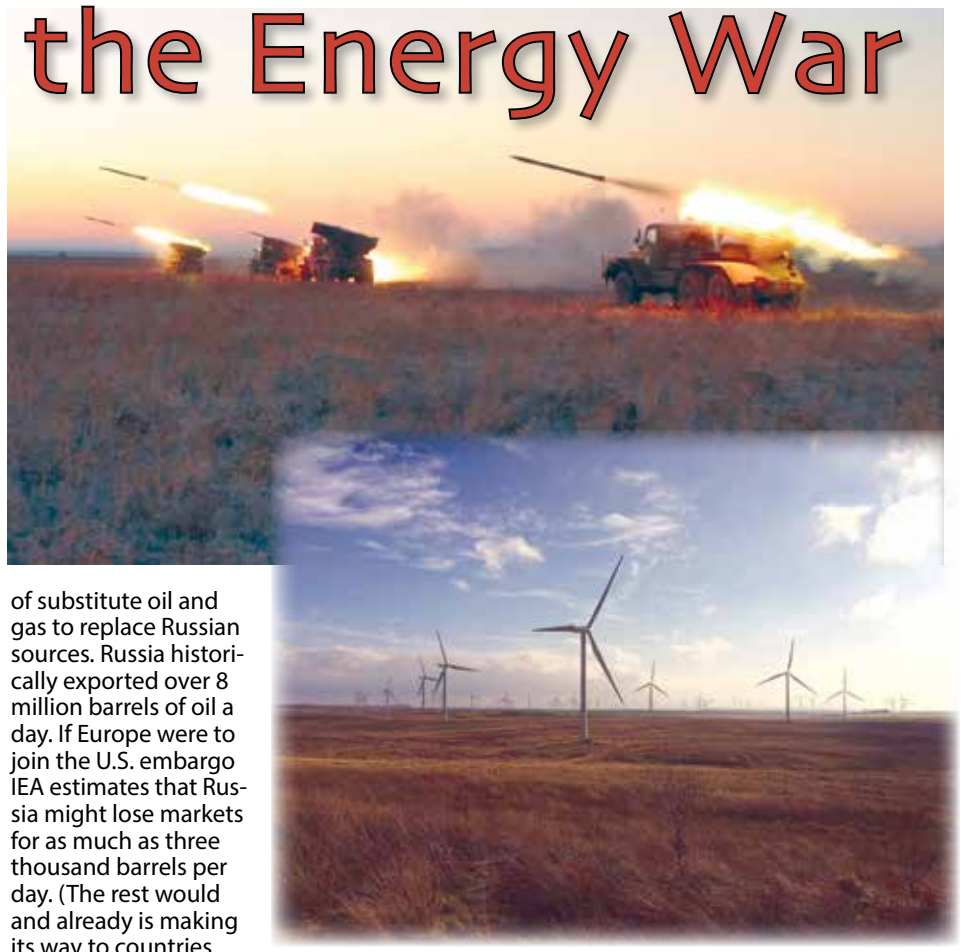

One type of weapon in the energy wars: Rockets firing from trucks in Ukraine. (Ukrainian Ministry of Defense. bit.ly/3mheSuv CC-BY-SA 2.0 bit.ly/3Nn399B). Inset: Another type of weapon in the energy wars: Wind farm reducing demand for oil and gas. (rachelalienergy, CC0 bit.ly/3Q2zrbx).

Securing Northeast Forest Carbon: Part 1

Charles Levesque

This is a first in a series of exclusive Green Energy Times articles on some myths about climate change and the role trees and forests play in mitigating climate change's effects.

We Shouldn't Cut Trees if We Care about Climate Change – Right? Wrong

It seems simple and intuitive, right? If we want our forests to help mitigate the effects of climate change, we should just leave them alone to grow. Sometimes simple ideas are correct, but this one is not – in fact it's dead wrong.

Quechee Gorge, Vermont. (Matthew Bellemare (bit.ly/3mdHQeR). CC-BY-SA 3.0 (bit.ly/2R5ti4X).

There are important myths surrounding this issue. There are some who believe if we don't harvest trees, then the forest keeps on growing and sequestering carbon forever. That is not true. Trees and forests, though often longer lived than humans, age as they grow bigger and older and their growth slows down – quite a bit, actually. Their sequestration of carbon also slows down.

And let's not forget that what this all about is climate change being caused mostly by greenhouse gas emissions from the burning of fossil fuels in electricity power plants, manufacturing facilities, heating buildings and transportation vehicles. Forests only offset some of those emissions here in the U.S. and in the world. The real way to reduce emissions is to slow or stop them at the emitting point – the power

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Concentration of CO2 in the Atmosphere

421.18

parts per million (ppm)

June 11, 2022

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GREEN ENERGY TIMES (G.E.T.)

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Kudos to Our Awesome Team
Helping *Green Energy Times* Save the Planet

Over past issues, we have been looking at how the *Green Energy Times* team of workers and volunteers makes emissions reduction and energy savings a personal issue, doing their part to reduce pollution of all kinds and make our world a safer place where people can live healthy lives. Now, we come to the example set by Barb and Greg Whitchurch.

The Whitchurches – should be well known to any regular reader of *G.E.T.* as writers who are especially knowledgeable about residential and commercial building and electric vehicles. Other things they do include volunteering by delivering *G.E.T.* in the area of Vermont bounded by Morrisville, Warren, Northfield and Plainfield.

They built their high-performance main house in 2002. It is heated entirely with wood from their property, and no fossil fuels are used at all. The wood is burned in a masonry stove, a parlor stove, and a cookstove – where cooking is done eight months of the year. All three of these stoves are equipped to provide domestic hot water. They have a composting toilet, solar hot water panels on the roof, and no clothes dryer. An upgrade to the household system is in the works in the form of geothermal heating and cooling.

In 2014 they built a stand-alone addition to their main house (connected by a breezeway) for Greg's elderly parents; it has won multiple efficiency awards. It is all-electric and complies with U.S. Passive House standards. Being so airtight and well-insulated, it uses less than $500 worth of electricity per year for all functions. It is also compliant with Americans with Disabilities Act standards. It has an induction range, heat pump heating, cooling, ventilation,, and a condensing washer-dryer – although drying is done on lines almost exclusively.

Both units share a gray water waste filtration, have induction-convection and microwave ovens, and share a wood pellet BBQ grill. The main house has been upgraded with triple-pane Passive House Certified windows now. Plus, this January they finished their second upgrade to their original solar photovoltaic system with backup. They now have a Net Positive 16kW which covers their entire home, cars and all equipment.

The Whitchurches are working toward an ever more sustainable lifestyle. They compost food waste and recycle other waste. They use battery-powered tools for outdoor work, including a mower, whacker, tiller, snowblower and chain saws. They admit to using one gallon of gas per year for a wood chipper and log splitter, though they have those things on their list of tools to replace with new ones powered by electricity.

Snow is an amazing insulating blanket on the Whitchurchs' almost flat roof. Barb stands on the path where Greg removes snow from the panels and "stores" it upslope on the roof.

Their cars are electric vehicles fully powered by batteries. The cars use far more electricity than everything else, but still far cheaper than gasoline. In fact, the cars are equipped to provide electricity to the house, and a need to do that has happened. Barb and Greg Whitchurch even equipped the cars with tableware, straws, leftover containers, and shopping bags to cut down on waste. They gave up flying several years ago.

They have a garden to grow tomatoes, beans, and peas, but they intend to expand that list. This is part of goals to eat more sustainable foods and reduce use of plastic packaging as much as possible.

They volunteer in environmental proselytizing with sustainable energy groups, including serving as board members of Vermont Passive House (VTPH.org) and the town energy committee in Middlesex, Vermont. Their activities for *G.E.T.* fit in well with this ♻

The Whitchurchs use their Niro for the 110-mile round-trip to pick up 5,000 copies (~1,100 pounds) of G.E.T. *each issue for distribution. (Photos: Greg Whitchurch)*

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Vermont Tackles Transportation Emissions

Vermont Climate Advocates Applaud Clean Transportation Measures in the FY23 Budget and Transportation Bill

Robb Kidd, Vermont Sierra Club

A broad coalition of environmental leaders have applauded the transportation investments included with the enactment of the Fiscal Year 2023 Transportation Bill, H.736, and the Fiscal Year 2023 Appropriations Act, H.740, which earned Vermont Governor Phil Scott's signature on June 9, 2022. The bills, H.736 and H.740 passed with strong tri-partisan supermajorities in both legislative chambers before arriving for Gov. Scott's signature.

These bills call for a suite of policies and appropriations to rapidly transform transportation choices. Especially for vehicle electrification, the bills call for Vermont to appropriate nearly $40 million dollars to meet our carbon reduction targets this year. Increased funding for electric vehicle incentives, deployment of electric vehicle charging infrastructure, and the continuation of zero-fare transit to assist low and moderate-income Vermonters to access clean transportation sources are all necessary steps toward Vermont meeting the required carbon reduction targets as adopted in the Global Warming Solutions Act and the Vermont Climate Action Plan. Vermont was fortunate enough to incorporate monies derived from the American Recovery Plan Act (ARPA), the Infrastructure Investment Jobs Act, the Vermont Transportation fund, and the Vermont General Fund dollars. Members of the coalition that support these transportation investments released the following statements in response:

"The Sierra Club appreciates the legislatures' hard work to make the essential investment in clean transportation choices. With the introduction of the Transportation Innovation Act and the Governor's recommendations, we set a course to ensure that these investments were made this year," stated Robb Kidd, Vermont Sierra Club Conservation Program Manager. "In the upcoming years, we hope to build upon this success and make greater investments in clean transportation choices to ultimately reduce vehicle miles traveled and to meet Vermont's required carbon emission reductions."

"Vermonters are paying too much for transportation, and this bill will help address that problem," said Elena Mihaly, Vice President and Director of CLF Vermont.

"With oil and gas prices soaring and the climate crisis worsening, the need to decarbonize Vermont's transportation sector and transition to cleaner, more affordable forms of transportation cannot be overstated," said VBSR Public Policy Manager, Jordan Giaconia. "From workplace charging grants to electric vehicle purchase incentives, this year's transportation bill includes historic investments that promise to keep more dollars in Vermonters' pockets and less pollution in our atmosphere. We applaud the legislature for taking yet another stride toward an equitable, prosperous clean transportation future and look forward to building on these investments to ensure both our businesses and our communities have the resources they need to go green."

"Vermonters are paying too much for transportation, and this bill will help address that problem," said Elena Mihaly, Vice President and Director of CLF Vermont. " Providing incentives to purchase electric vehicles and supporting public transit are two huge ways we can reduce this burden on residents. With polluting emissions from transportation rising, we can't afford to wait any longer."

"Huge thanks to legislative leaders who recognized the need for far greater investments in cleaner, multimodal, more equitable transportation solutions," said Johanna Miller, Energy and Climate Program Director at the Vermont Natural Resources Council. "Vermonters are feeling the financial pinch at the pump, tethered to a dirty, price-volatile international commodity market. The significant clean transportation investments this year will help shift that dynamic, expanding programs that reduce our reliance on imported oil and gas, save Vermonters money and cut the pollution that is warming our planet."

"The investments in clean transportation in this year's budget and transportation bill represent a historic step forward, and a good foundation for Vermont to build on," said Ben Edgerly Walsh, Climate and Energy Program Director with the Vermont Public Interest Research Group. "In the coming months and years we absolutely must build on this foundation to actually meet our required climate targets, something enabled but not ensured by these significant investments."

"Drastically decreasing greenhouse gas emissions from Vermont's transportation sector is critical for combatting the climate crisis. The programs funded in this bill are important steps in reducing greenhouse gas emissions and will speed up Vermont's moving to electrify its transportation sector," said Peter Sterling, Executive Director of Renewable Energy Vermont. ♻

Record Amounts of New Renewables Capacity

George Harvey

Both in the United States and in the rest of the world, record amounts of renewable capacity are coming online. There were still increases in carbon emissions in 2021, including from coal-burning power plants, but that was largely because of the economic rebound from restrictions related to Covid-19.

For the first time, over 10% of the electricity generated worldwide was from solar and wind power, according to research from the U.K. think tank Ember (https://bit.ly/GET-2021-energy-1). Fifty countries got more than 10% of their electricity from solar and wind, and these include most of those that use a lot of power. The U.S., Mexico, Brazil, Argentina, and Chile are on that list, as are all of the countries in western Europe except France, which is heavily dependent on nuclear power, and Norway, which is heavily dependent on hydro-electric power. China is on the list, as are Japan and Australia.

Solar array on a Massachusetts landfill. (Massachusetts Dept. of Environmental Protection (bit.ly/3teSkhF). CC-BY-SA 2.0. (bit.ly/3Nn399B).

Fossil fuels and nuclear

Since the boom in fracking, use of natural gas has increased rapidly in the U.S. There are some important points that have to be made about that fact, however. One is that natural gas use has largely displaced the use of coal. Another is that the growth in use of natural

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Transportation in Vermont is Going ELECTRIC

Wayne Michaud

With strong encouragement from the state, the technological innovation of cleaner transportation is taking hold in Vermont, featuring all-electric vehicles (EVs).

Vermont EV and plug-in hybrid registrations have spiked to about 6,600 in recent months, and that demand for EVs in Vermont is now third best in the U.S. But the state, mindful of 40% of its greenhouse gas emissions coming from transportation, has a robust goal of increasing EVs on the road to 126,000 by 2030.

A Host of State Incentives Sales

Vermont has a number of incentives from various sources to encourage purchasing or leasing of new low- to zero-emission vehicles:

- Federal tax credits of $2,500-$7,500 (depending on battery size). While this has phased out for Tesla and GM, it is still in effect for many other manufacturers.
- State of Vermont purchase or lease incentive of $1,500-$4,000 (depending on battery size and income level).
- Vermont electric utilities in many parts of the state offer cash incentives that vary according to vehicle battery size, and new or used. Some also offer credits for home charging equipment, plus lower rates for off-peak charging.
- MileageSmart: the State of Vermont provides a used hybrid (40 MPG or better) or electric vehicle incentive program for income-eligible households. Participants receive 25% of the initial price of the vehicle, up to $5,000.
- In addition, in 2021, the state authorized a $4.5 million transportation bill that further supports EV purchase or lease incentives, creates the Replace Your Ride Program that provides $3,000 for Vermonters to scrap older, high-polluting vehicles for cleaner ones, and establishes an electric bike incentive.

Vermont is also a participating state in California's Zero Emission Vehicles Initiative that is designed to achieve a state's long-term emission reduction goals by requiring auto manufacturers to offer for sale specific numbers of the very cleanest cars available.

(Image: Public domain, modified by Wayne Michaud)

EV Benefits Over Ice Vehicles

EVs, while currently more expensive to purchase than internal combustion engine (ICE) vehicles, should reach price parity with them by the mid-2020s. In fact, EVs are already in many ways cheaper than ICE vehicles over their life cycles, thanks to being less expensive to power and maintain. EVs use no gas, no oil, and fewer fluids. They have significantly fewer moving parts compared to ICE vehicles, including no engine, no exhaust system and just a one-speed transmission. And this is combined with built-in brake regeneration in which the engine helps slow the vehicle to reduce brake wear, while simultaneously recharging the battery.

Another big plus with EVs is that ICE vehicles are extremely inefficient. On average, only one-fifth of such a vehicle's fuel source, gasoline, goes toward propelling them. The rest is expended as heat and friction. On the other hand, the motors of EVs convert over 85% of electrical energy into mechanical energy, or motion, on average making them about four-fifths efficient. This also results in corresponding CO_2 emissions reductions.

State Charging Station Infrastructure

Vermont has made a commitment to building a public charging network that currently offers 318 public level two and level three (DC fast charge) charging stations. And the state is set to advance this infrastructure further when it receives a $21.2 million windfall in federal funding over five years to help support fast-charging stations across the state.

EV Performance in Cold Weather

TRACTION: EVs perform similarly to ICE vehicles in winter conditions with better traction attributed to a good set of winter tires. More all-wheel drive (AWD) EVs are now being offered (and soon four-wheel drive EV pickups). Instead of using a driveshaft to send power to the rear wheels as in ICE vehicles, for AWD EVs, one electric motor works to power the wheels of the front axle with a second electric motor working to power the wheels of the rear axle.

RANGE: EV battery range is diminished 20% or more, depending on how cold it is. Heating the cabin is the biggest range eater. However, EVs equipped with heated seats and steering wheel minimize this impact. Solutions to minimizing range loss include checking tire pressure, utilizing pre-timed heating systems, using indoor parking facilities where possible, minimizing the use of cabin heating, and driving conservatively.

EVs and the Environment

Environmentally, EVs are not perfect. This includes the environmentally detrimental process of the mining of cobalt for their power source, the lithium-ion battery. But studies show that EVs have a 60-68% reduction in life cycle emissions versus ICE vehicles which use oil, a source that pollutes from extraction to emissions. And EVs will be even cleaner going forward.

As to EV batteries and recycling, most batteries are still being used in their first life powering a vehicle. As a second life, batteries can be repurposed into commercial or residential stationary electricity storage systems, such as Green Mountain Power's Tesla Powerwall backup protection. Recycling the battery metals (lithium, nickel, manganese, and cobalt), cells, and other parts will be a challenge that will require technological advances such as battery makers designing their products with recycling in mind, plus the need of specialized recycling centers that will minimize transport of these materials.

Links available in the posting of this article on our website: greenenergytimes.org.

Wayne Michaud is Executive Director of Green Driving America Inc., a non-profit based in California with a branch location in Vermont. He is the proud owner of a 2020 Chevy Bolt EV and will never go back to owning an ICE vehicle. ♻

Charging Across America Challenge Sets Record of 111 hours and 30 minutes

The first-ever "Charging Across America Challenge" event took place in April. The event was covered in the February 2022 issue of *G.E.T.* (https://www.greenenergytimes.org/2022/02/the-birth-of-the-charging-across-america-challenge-2022/). Rob Swartz, owner of Energica of New England and Rob's Dyno Service in Gardner, MA and co-rider, Steven Day, attempted to break the Cannonball cross-country electric motorcycle record of 178 hours and 17 minutes piloting Energica electric motorcycles. Both riders simultaneously rode coast-to-coast in opposite directions following the 2,906-mile route of the original Cannonball Run, creating a unique "race within a race." The event started April 18 with finish-line completion on Earth Day, April 22. Steven Day started in Redondo Beach California and ended in New York City's Red Ball Garage completing the course in a record-breaking 111 hours and 30 minutes.

Steven Day (left) and Charging Across America founder, Rob Swartz, discuss their cross-country e-motorcycle record attempt at Swartz's Energica of New England electric motorcycle dealership in Gardner, Massachusetts. (Sandra Crossman)

Congratulations to event founder Robert Swartz who journeyed over 1,000 miles (from New York City to Morris, Illinois), much of it through treacherous snow and freezing rain. While unavoidable circumstances forced him to depart the event early, Swartz eagerly looks forward to making a comeback at Charging Across America Challenge 2023! ♻

The Latest and Greatest E-bike News

George Harvey

In April, electric bicycles (e-bikes) outsold other electric vehicles in the United States by a fair margin. While 608,000 electric cars were sold, there were 880,000 e-bikes imported, others were made in the U.S., and dealers were complaining that they could not fill demands. And estimates are that in Europe, e-bikes will be outselling all other vehicles within ten years, according to Bicycling (https://bit.ly/GET-ebikes-1).

ElMundo e-bike transporting a file cabinet and 50 pounds of groceries in basket and pannier on other side. (chicargobike.blogspot.com)

An e-bike is not considered a motor vehicle, because it can be pedaled and has limited speed. Beyond that, however, e-bikes come in a variety of shapes and sizes. On the one hand, they can be purely recreational, but on the other, they are revolutionary for bike commuters. Electric cargo bikes are great for carrying groceries and children. Others are used by major retailers and delivery services for "last mile" deliveries. When the costs of operating e-bikes and delivery vans are compared, it is easy to see the e-bikes' advantage.

VBike promotes e-bikes in Vermont. We asked Dave Cohen, its Founder and Director, to give us an update on the latest news for e-bikes. There is a lot to talk about.

There have been many technical improvements. They include some electronic systems we might not normally associate with bicycles, such as Wi-Fi, smart phone, and so on. There are some, however, that are very important improvements to the bicycles themselves. One area of change is more efficient motors. Motors come in more types, both for mounting and for operations.

New developments and improvements in geared hub motors have made them preferable over direct drive hub motors for most bike manufacturers. For example, a geared motor can be significantly smaller and lighter than a direct drive motor, but also have considerably more torque for climbing hills. However, one thing that a direct drive motor can do that a geared motor cannot is regenerative braking to charge the battery by recovering energy when the bike is going downhill or being braked.

While traditional e-bike motors were mounted on one of the wheel hubs, we now have motors available that can be mounted at the crank. Called 'mid-drive' motors, they can be more efficient than the older types. Mid-drive motors can also be operated with belt drives instead of chains.

Belt drives were introduced for e-bikes about fifteen years ago by Gates Corporation, which specializes in all sorts of belt drive systems. In the last few years, belt drives have become much more common on bikes, as they have some attractive advantages. They are quiet and require less maintenance than chains. They do not require oil and do not rust. They also tend to last longer.

New batteries have also come along. While they tend not to be much less expensive than the old ones, they do tend to hold more energy. The result is that new, efficient motors and new batteries can combine to provide much longer range. According to Cohen, mid-drive motors are especially good at this. It is realistic to think of 40-mile ranges for biking. Also, some e-bikes can have their batteries swapped out, doubling the range.

Increasing use of cargo bikes means that more people are relying on e-bikes to do their shopping or move kids around. In some cities, it also means deliveries are being made more often on bikes, and this reduces emissions in densely populated areas.

Of course, e-bikes are not inexpensive, though there are incentives. Prices start at a little below $1,000 and go up. But there are rebates, loans, and subsidies available, and these can come from states, municipalities, non-profit organizations, and electric utilities. Vermont is a leading state in such programs. Four Vermont utilities each offer $200 rebates (https://bit.ly/GET-ebikes-3). Also, VSECU has low-interest loans (https://bit.ly/GET-ebikes-4).

One thing that Dave Cohen brought up is worth thinking about. For most people, e-bikes can be operated at faster speeds than conventional bikes. That is important for safety. At the higher speeds, people driving motor vehicles have e-bikes in sight longer than conventional bikes, and that can make e-bikes safer.

Most people, regardless of where they are, can find resources for guidance. Some people in Vermont can try out an e-bike at e-bike lending libraries, which were pioneered in the state. Local Motion has information on these and other programs in Vermont (https://bit.ly/GET-ebikes-5). Employees and owners of stores that sell bikes often take deep interest in the products they sell. For example, Tom List of Hanover Adventure Tours & Hostel told us, "We have about fifty bikes, Magnums and Yamahas, that people can buy, rent, or test ride."

Vermont, however, has another resource other states do not have as yet: Through Vbikes, Vermonters can get free consultations with experts on e-bikes for household or business use (https://bit.ly/GET-ebikes-6a).

The Vermont programs are groundbreaking, but they have been successful enough that they should be considered in other states. We suggest those who are interest contact their legislators. ♻

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New Hampshire: Charging Desert, With Few Signs of Hope on The Horizon

Sam Evans-Brown

When it comes to the number of public electric vehicle (EV) chargers installed per capita, New Hampshire ranks last in New England by a long shot. The Granite State has only one charging port per 4,400 people. The next closest in the region is Connecticut, at one port per 2,900 and Vermont leads the nation with a port for every 750 residents.

Perhaps this doesn't seem like much of a problem, since currently around 80 percent of charging happens at home. However, most early adopters of EVs have been higher income individuals with more access to home charging, who buy electric as a second vehicle. Without public charging, electric vehicles will remain out of reach for single-vehicle households who cannot charge at home, because they live in apartments without off-street parking. Without public charging, lighter, cheaper electric cars with smaller batteries and shorter ranges will never be a viable choice for many families looking for a more affordable transportation option. And—crucially for a state where the number one industry is tourism—without public charging, tourists who drive electric will need to bend over backwards to figure out how to charge up to get home again.

So far, New Hampshire has struggled to get out of its own way to build this infrastructure.

In 2019, the state asked for proposals to build fast chargers around the state using $5 million given to the state as part of the Volkswagen "Dieselgate" scandal. That initiative failed, because the state put unreasonable requirements on the program, and no qualified applicants came forward. Today, the state is trying again to spend those Volkswagen monies. We are expecting the decision on who will get the funding this summer, but there are reasons for concern.

For one, the state has determined that "make-ready" investments aren't eligible for Volkswagen funding. Make-ready includes anything the utility will eventually own: transformers, conduits, meters, poles and wires. The utilities themselves want to invest in this infrastructure (and get paid for it!) but New Hampshire's regulators have revealed themselves to be deeply reluctant to let the utilities make these investments.

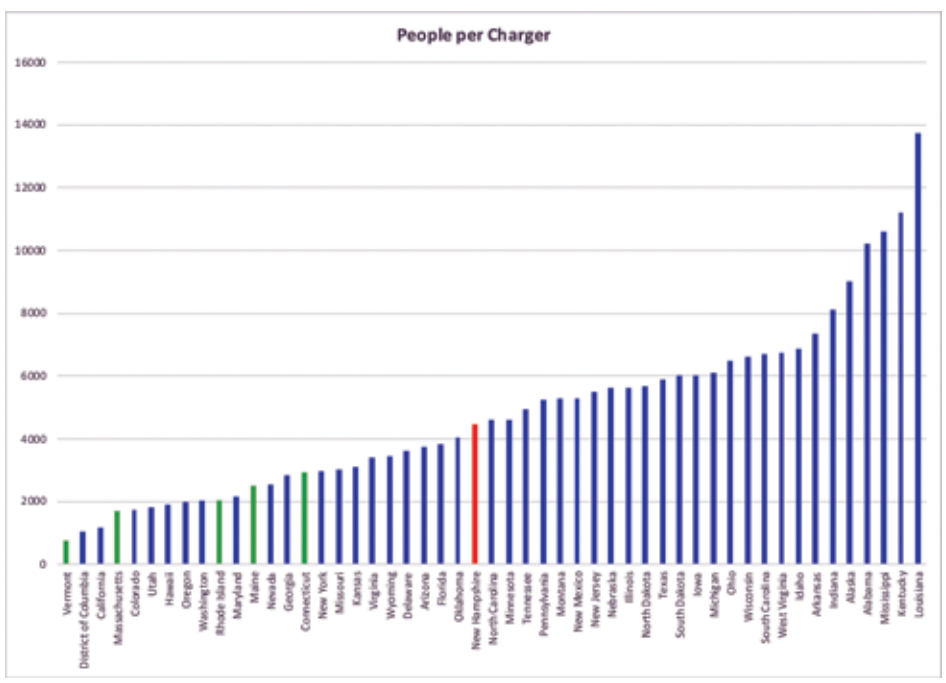
Unitil, the utility serving the capital region and seacoast, had proposed a $2.36 million make-ready investment package. It would have created hundreds of local chargers on main streets throughout their service territory, and four fast charging locations as well. But, in early May, the commissioners of the Public Utilities Commission rejected that proposal entirely, grumbling about it being too expensive.

All eyes now turn to Eversource's $2 million EV infrastructure proposal, which is intended to help bolster the Volkswagen funding. If the PUC rejects that investment too, the winners of the most recent attempt to spend the Volkswagen funds will have to decide if they can shoulder the burden of paying for the poles, wires and transformers themselves. If they can't make the numbers work, we will once again fail to spend the windfall money in the Dieselgate trust fund.

Fortunately, the state will also receive $17 million over the next five years to build fast chargers along major interstates and highways. This money was included in the infrastructure law that managed to make it out of Washington, D.C. last year. New Hampshire's Department of Transportation is currently crafting a plan for how it will use that money, which is due at the beginning of August.

The fact remains, though, that New Hampshire has had a slow start investing in the transition to electric transportation. We cannot rely on the federal government alone to fund the infrastructure needed to capture the benefits of a decarbonized transportation sector, like reduced fuel and maintenance costs, and lower climate emissions. Lawmakers will need to step in and let regulators know that investing in our electrified transportation future is in the public's interest.

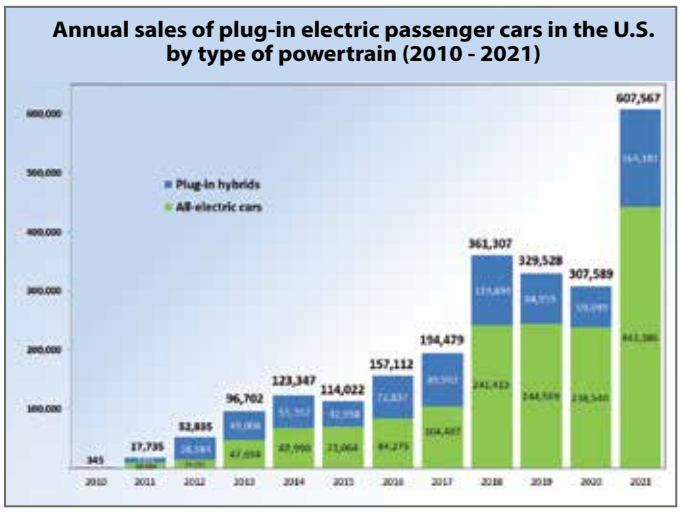
Sam Evans-Brown is the executive director of Clean Energy New Hampshire. He was an energy and climate journalist for ten years before transitioning to the policy arena. ♻



New Hampshire is falling behind the rest of the region when it comes to charging infrastructure. (Source: Alternative Fuel Data Center)

How Are EV Sales Doing in the USA?

George Harvey



Most of us know about Tesla, a maker of electric vehicles (EVs), and have seen its cars driving around. Many of us know that Elon Musk, the CEO of Tesla, has been rated as the richest person on Earth, largely because of the company. It seems, however, that not many of us know much about electric vehicles. We should ask ourselves why that is. After all, stopping climate change will require us to stop emitting carbon dioxide created when we burn gasoline and diesel oil.

In February of 2022, Reuters published a graphics article "The long road to electric cars," on electric EVs in the United States (https://tmsnrt.rs/3mpli9G). That article tells us that IHS Markit projects U.S. EV sales to be 45% of the total car market in 2035, a rate at which about half of the cars on the road would be EVs by 2050. Believing that is not a fast enough transition, President Joe Biden has set a goal to have 50% of all car sales be EVs by 2030.

In 2021, the Reuters article says, full battery EVs accounted for 3% of all U.S. car sales, and hybrids were 5%. Clearly, to reach the president's goal of 50% by 2030, there will have to be an enormous growth in EV sales.

It is worthwhile to understand how 3% of car sales in the U.S. compares to sales in other countries. Sales of cars in most – possibly all – markets have fallen badly in the last two years, but despite this, sales of EVs have increased greatly. This is true in Germany and France, respectively the largest and second largest car markets in Europe. A look at a couple of other markets is compelling, however.

In Norway, cars powered entirely by gasoline and diesel took 7.9% of the market. Plugless hybrids won another 7%. Plugin hybrids accounted for 11.9% of the cars sold. The rest of the cars, 73.2% of all cars sold, were powered entirely by batteries, according to a CleanTechnica article (https://bit.ly/GET-EVs-1). That is especially interesting because oil and gas have made up a very large percentage of Norway's income for many years.

Another country that is especially interesting is Denmark. In January of 2020, 3% of the cars sold were battery-electric, and 4% were plugin hybrids. In those respects, the Danish market at that time was similar to what the U.S. market is today. The interesting thing is that in December of 2021, battery-electric cars took 27% of the Danish market, and plugin hybrids took 31%, according to an article at CleanTechnica (https://bit.ly/GET-Evs-2). That change shows what can happen in less than two years.

We could conclude that the EV market in the U.S. is barely moving, compared to what is going on in other countries. There are some signs of hope, however. While it would not be possible for the percentage of EVs sold in the U.S. to be multiplied by ten in two years, as it was in Denmark, car makers in this country are putting billions of dollars into preparing plants to manufacture EVs.

In some cases, the EV revolution's course is planned. Buick, for example, has announced that as of 2030, it will not make any more cars powered by fossil fuels and will only make battery EVs. And GM as a whole will convert emissions-free cars entirely by 2035. Mary Barra, CEO of GM, has said that the company intends to overtake Tesla's leadership in the EV market by 2025, only three years off, according to an article at Motley Fool (https://bit.ly/GET-EVs-3).

We should consider why EVs have grown so slowly in this country. Clearly people have been disinclined to buy them because of perceptions about them. We can point out that these perceptions are, in fact, mistaken.

Many people seem concerned about range issues. Such issues are not based on driving range for everyday life, however. Most people seldom travel more than 50 miles in a day, but most current EVs have ranges of 200 miles or more and can be charged at home, overnight.

Some people are concerned that EVs lack power. The truth is that many EVs have much more power than their fossil fuel counterparts. In fact, Jay Leno set a record for the quarter mile in a production car, driving a Tesla Model S Plaid. The record had been 9.4 seconds, but Leno, who is hardly a professional driver, made the run in 9.247 seconds, according to an article at Yahoo (https://yhoo.it/3MyhSNM).

The cost of an EV is a concern for many people. But a bit of math will show that because EVs are so much less expensive to drive, its cost is actually lower over time.

One barrier has been governments at various levels exercising control over the marketplace in ways that make it difficult to sell an EV. We can only address that in the polling booth or hope that it is successfully addressed in court.

All told, however, we anticipate big changes in the next few years, possibly changes some people can't imagine. ♻

AdobeKIA KIA Niro _Adobe Stock image/303229672

MEET YOUR SOLAR INSTALLERS

In the February 2022 issue of *Green Energy Times*, we ran a center feature called "Green Energy Times Solar Installers," providing information supplied by installers in our region. Please visit "GET's Guide to Solar Installer's" at www.bit.ly/GET-solar-installers. The series is about each of the the individual companies that took part in our survey, providing readers with more information about each of them. These articles will continue throughout this year. (Any solar installer not on our list who wants to be on it should contact us at info@greenenergytimes.org.)

Here we are continuinging our "Meet Your Solar Installer" series, from A to Z, with Barrington Power (Barrington, New Hampshire)and Catamount Solar (Randolph, Vermont).

BARRINGTON POWER, BARRINGTON, NEW HAMPSHIRE

George Harvey

Jack Bingham, managing member of Barrington Power, made one thing very clear about his view of investing in solar power. It is a good place to put away funds for retirement. "You can invest in all sorts of things," he said. "But what is more reliable than solar power?"

Barrington Power has a very different business model than most other solar installers. The company website explains this by stating, "What sets Barrington Power apart in the new solar revolution is its ability to provide a variety of solutions to prospective commercial, municipal and not-for-profit organizations. Businesses can avoid capital commitments altogether, or they can benefit from structured investments to maximize potential financial returns when they do invest. Municipalities, public schools, fire stations, maintenance operations, churches, hospitals, and clinics can take advantage of government subsidies and either reduce the capital cost of renewable energy investments or bypass them altogether."

Looking beyond the investments, however, Barrington Power is mission-driven. Both Jack Bingham and the company's financial expert, David Russell, are "keenly aware of the urgent needs in addressing climate change. Our goal is to do whatever we can to support renewable energy. That begins with solar electric power and quickly moves to distributive power, storage and sustainability."

In the third quarter of 2020, Barrington Power installed a 144kW solar array at Effingham Elementary School in NH. Rt: The 34.4kW rooftop array at Vaughan Learning Center, North Conway, NH. (Images courtesy of Barrington Power)

Barrington Power's expertise is in the specific engineering and management needed to develop the projects. What it cannot do, it outsources, as it hires the contractors to do the work. At the same time, it sources the materials that are needed for a project. Because of this approach, it is not tied to a limited design that is adapted to all projects regardless of suitability. It can use the best resources available, whatever they may be, and whatever technologies they use. A project can be different from those that have been built before, but with the right contractors, it can be done by experts familiar with the technologies.

The solar systems that Barrington Power has built have mostly gone into central New Hampshire, with some in neighboring areas of Vermont. As to the types of customers, Bingham said, "Most of our customers are municipal and schools, but we are starting to do more farms. USDA has a fair amount of money for grants and rebates. There is also money from the state. Some can get a lot of grant money."

The projects Barrington Power has done have ranged in size from 16 kilowatts (kW) to 3.3 megawatts. To illustrate how it works, it uses one system that it installed as an example. That was a 145-kW array at the Mount Ascutney Hospital in Windsor, Vermont. The hospital was unable to take advantage of tax incentives because as a non-profit it paid no taxes. On the other hand, Barrington power, a for-profit company, can take the tax benefits and owns the array. Because of this arrangement, the hospital can get its electricity at significant cost reductions without any need for up-front financial outlays.

Barrington Power also offers preventative maintenance services for systems of commercial customers that are greater than 40kW. These are offered under annual maintenance

Cont'd on p.9

CATAMOUNT SOLAR, RANDOLPH, VERMONT

Catamount Solar is a bit different from other installers in a couple of important ways. One thing is that it is employee-owned. In fact, Catamount claims to be Vermont's only employee-owned solar installer. Nine of its eighteen employees are owners, and the rest are on track to become owners. Ownership requires a minimum of three years of work at the company and a vote by owners. The arrangement makes for a very devoted group of employees who work with a different mindset than workers elsewhere.

The employee-owner paradigm has some effects in the workplace. For example, when data showing results of the work are reviewed, all of the workers take interest. Whether owners or potential owners, they want to have the company be as successful as possible, with the best product it can deliver.

Copeland Furniture's 500kW solar system was installed on a polluted brownfield in Bradford, VT. (Isaac Copeland) Read full story in the August 2016 edition of Green Energy TImes.

Another thing that sets Catamount Solar apart is its claim to be "Vermont's #1 Off-Grid Solar Installer." This is important because off-grid systems can be very different from one another. The systems vary quite a lot in their needs and assets, so the designer of a system has to be able to put together a set of specifications that are specific to the site where it will be built.

Catamount works from an office in Randolph, Vermont, almost in the center of the state. Its customers may be from just about anywhere in Vermont, with a few communities in New Hampshire added. Its installations are both residential and commercial. It installs solar systems and batteries, grid-tied and off-grid. Catamount also installs cold-climate heat pumps.

500kW ground-mount system installed in Royalton, Vermont. (Catamount Solar)

While the Covid pandemic challenged many businesses, Catamount made use of it as a time when employee-owners could develop skills for doing certain kinds of work without travel. Consultations could be done over the phone or through virtual meetings. To some extent, site evaluations can be done using such tools as Google Earth. Though they were by no means eliminated, trips to sites are reduced to a great extent, saving on both vehicle use and energy. Company owner-employees saw the opportunity to improve efficiency and reduce waste, producing an improvement that may outlast the pandemic because of its positive benefits.

For potential customers, the first step is to get a site evaluation to address the questions of whether the site has potential for generating electricity from solar photovoltaics. This is done for free.

If a site does not have potential for solar power, it is not time to despair. Catamount can direct customers to community solar projects, either its own or similar projects of other installers. The projects that a customer can get involved in depend alot on what utility serves the area, and many customers have them available. Liz Smithies, who is in charge of Catamount's inside sales, told us, "I always advise them not to wait, because community solar systems tend to sell out rather quickly."

If a site does have potential for solar power, however, the next step is a detailed proposal from Catamount. The proposal provides the customer with information about what will be in the solar system, specifics about how it will be installed, what the cost benefits will be, and what tax credits, rebates, or other incentives will be available. In addition to guiding customers to incentives and benefits, Catamount also helps with permitting, which is important assistance to customers.

As a matter of happenstance, Catamount opened up a new warehouse and increased its inventory of solar panels just before an important government action reducing panel availability. The federal government had blocked importation of solar panels from four countries in southeast Asia because of high tariffs on solar panels from China and a lack of clarity about where the panels from the four countries were actually made. This is an important issue for many large installers, as it has driven the price of solar panels up from 38 cents to 55 cents per kilowatt, but Catamount has no problems with availability so far.

Smithies also spoke about the reasons people need off-grid systems and why they are particularly important today. With the Covid-19 pandemic, increasing numbers of people are attracted to Vermont as a place to live. One problem with land in Vermont is that it does not always have easy access to electricity and installing grid power can be very expensive. In fact, Nancy Rae Mallery, the publisher of *Green Energy Times*, bought land 20 years ago, knowing that she would be installing an off-grid system, with the understanding that it would be less expensive than getting a grid connection.

With cost comparisons and the current cost of off-grid systems, which are arguably still low despite cost increases of panels, there is a strong demand for an installer with Catamount's experience.

The Catamount Solar web site is catamountsolar.com. ♻

<< BARRINGTON POWER
Cont'd from p.8

agreements. They include inspections of everything from solar panels and inverters to the vegetation, drainage, and fences. A customer can take an option for a contract for corrective maintenance, as well.

Today, some larger companies are suffering from a lack of solar modules, while the federal government investigates the sources of modules and the question of whether they are avoiding proper tariff payments. When he was asked about this, Bingham pointed out that solar panel prices have jumped from 38¢ per watt to 55¢ per watt, which is a big increase, but apart from some of the really large solar projects, the industry is still taking orders for new systems. He also expressed some regrets about the state of the industry in this country, explaining that we really should have established the solar industry better in years gone by. He added, "I don't see how we get the American solar panel industry back."

Bingham is very concerned about the problems of climate change and security. He said, "We need major solutions to problems, and they are not coming fast enough." In particular, he said, "We need new storage for solar and wind." His company, Barrington Power, is working on taking on the problems and finding solutions.

Barrington Power's website is barringtonpower.com. ♻

Picture a 100% Solar Powered Farm in Vermont

– Now Check out Big Picture Farm in Townshend

George Harvey

Big Picture Farm (BPF) in Townshend, Vermont, was started by Louisa Conrad and Lucas Farrell as a place to raise goats and make cheese and other products from their milk. They started out with three animals, clearly a modest beginning. In the time since then, the farm has grown and prospered. BPF has about 100 acres of land and a herd of about 40 productive goats, and it is now known nationally as a source of award-winning caramels. Conrad told us, "The secret of the caramels is the milk they are made from." That may be the secret, but it is one that she can safely share. Not everyone has goats like hers.

Goats at the old tracking system. A new 33kW rooftop solar array was installed on the barn at Big Picture Farm by Southern Vermont Solar. With this addition to their existing solar array, BPF has 100% of its electricity provided by the sun. (Big Picture Farm)

Their goat dairy is Animal Welfare Approved. They graze on the freshest grass, because they are moved to fresh forage twice each day. Conrad and Farrell take care to protect the wetland areas of the farm from the goats, as a sustainable approach to land management. Also, notably, the producing goats are only about half of those on the farm, because older goats are allowed to retire to graze happily in the fields. Conrad said of them, "They are just living the good life."

The BPF approach to operations goes beyond taking care of their herd, and Conrad told us about other things that set BPF apart. "We want to make the business as low-impact and sustainable as possible," she said. For example, they are now in the process of eliminating use of virgin plastics from their packaging, as well.

Their use of energy is a matter of importance. Several years ago, they had two tracking solar systems installed to provide 50% of the electricity they use. BPF has grown, however, and that means it needs more electricity than it did in the past, so now the tracking solar systems provide only about 25% of what is needed.

Recently, Conrad and Farrell decided to expand their use of solar photovoltaics, and they contacted Victoria Roberts of Southern Vermont Solar. After examining the options, they decided to install a new solar system on the roof of a barn. The decision to do this was not trivial, because the barn is old and the roof needed to be stronger. They decided to replace the part of the roof supporting the solar panels, about half of the roof.

The new system has a capacity of nearly 33 kilowatts. It consists of 84 Hanwha modules, each rated at 390 watts. It has Enphase micro-inverters. The new rooftop system supplies all the demand not covered by the old tracking system, so now, BPF has 100% of its electricity provided by sunshine.

Southern Vermont Solar also assisted BPF with getting financing by helping with grant applications. One grant came from REAP (Rural Energy for America Program), which is funded and administered by the U.S. Department of Agriculture.

The overall experience that Louisa Conrad and Lucas Farrell had with the solar installation was very positive. Conrad said, "Southern Vermont Solar was amazing. They did a fabulous job."

The Big Picture Farm website is bigpicturefarm.com .The Southern Vermont Solar website is svtsolar.com. ♻

Large-Scale Renewable Energy Projects To Deliver Clean, Affordable Energy To New Yorkers

On June 2, Governor Hochul announced awards for 22 large-scale solar and energy storage projects that will deliver enough clean, affordable energy to power over 620,000 New York homes for at least 20 years. As the state's largest land-based renewable energy procurement to date, these projects will spur over $2.7 billion in private investment and create over 3,000 short- and long-term jobs across the state. These awards accelerate progress to exceed New York's goal to obtain 70% of the state's electricity from renewable sources by 2030 on the path to a zero-emission grid by 2040 as required by Climate Leadership and Community Protection Act. These awards will strengthen the state's current pipeline of renewables to power over 66% of New York's electricity from renewable sources.

The large-scale renewable energy projects in the *G.E.T.* distribution region are as follows.

- **Stern Solar:** Stern Solar LLC, a CS Energy affiliate, will build a 19.99-megawatt (MW)solar facility in the town of Schaghticoke, Rensselaer County.
- **Fort Edward Solar Farm:** Fort Edward Solar LLC, a Boralex affiliate, will build a 100-megawatt solar facility in the towns of Fort Edward and Argyle, Washington County.
- **Scotch Ridge Solar:** Scotch Ridge Solar LLC, a Nexamp affiliate, will build a 20-megawatt solar facility in the town of **Duanesburg, Schenectady County.**
- **ELP Stuyvesant Solar:** ELP Stuyvesant Solar LLC, an East Light Partners affiliate, will build a 19.99-megawatt solar facility in the town of **Stuyvesant, Columbia County.**
- **Easton Solar Farm:** Easton Solar LLC, a Boralex affiliate, will build a 20-megawatt solar facility in the town of **Easton, Washington County.**
- **ELP Rotterdam Solar:** ELP Rotterdam Solar LLC, an East Light Partners affiliate, will build a 19.99-megawatt solar facility in the town of **Rotterdam, Schenectady County.**
- **Yellow Barn Solar:** Yellow Barn Solar LLC, a CS Energy affiliate, will build a 160-megawatt solar facility in the towns of **Lansing and Groton, Tompkins County.**
- **Mill Point Solar 2:** ConnectGen Montgomery County LLC, a ConnectGen affiliate, will build a 100-MW Solar facility in the town of **Glen, Montgomery County**.
- **SunEast Flat Creek II Solar**: SunEast Flat Creek Solar LLC, a SunEast Development affiliate, will build a 100-megawatt Solar facility in the town of **Root, Montgomery County.**
- **Newport Solar Farm:** Newport Deerfield Solar LLC, a Boralex affiliate, will build a 130-megawatt Solar facility in the towns of **Deerfield, Marcy and Newport, Oneida and Herkimer County.**
- **Foothills Solar Farm:** Foothills Solar LLC, a Boralex affiliate, will build a 40-megawatt Solar facility in the town of **Mayfield, Fulton County.**
- **Columbia Solar Energy Center:** Columbia Solar Energy Center LLC, an EDF Renewables affiliate, will build a 350-megawatt Solar facility with 20 megawatts of co-located energy storage in the towns of **Columbia and Litchfield, Herkimer County.**

The Long Island Solar Farm (LISF) is a 32-megawatt solar photovoltaic power plant located on the Brookhaven National Laboratory site. It is generating enough renewable energy to power approximately 4,500 homes and is helping New York State meet its clean energy and carbon reduction goals. (Brookhaven National Laboratory/Flickr)

The other projects are located in central New York's Cayuga County, the North Country counties of Lawrence and Franklin, and western New York counties of Niagara, Allegany, and Chautauqua.

Creating New Jobs

New York's advancement of renewable energy has resulted in significant private investment, new jobs, and economic development for local communities in more than 30 counties across the state.

Investing in Marginalized Communities

Through the newly awarded projects, developers have committed nearly $86 million in investments in disadvantaged communities throughout the state, including community-based investments such as new occupational apprenticeships, scholarship programs, and summer camps focused on supporting local disadvantaged communities. Additionally, all developers have committed to ensuring that workers associated with the construction of projects are paid a prevailing wage, a standard set by the NYS Department of Labor.

Environmental Protection a Priority

For five consecutive years, the New York State Energy Research and Development Authority (NYSERDA) has demonstrated a commitment to implementing the most ambitious clean energy agenda in the United States. With the addition of these new projects, NYSERDA is on the path to building a renewable electricity pipeline capable of powering the equivalent of two-thirds of the state. These projects will generate approximately 4.5 million megawatt-hours of renewable energy annually, enough to power over 620,000 homes, and will reduce carbon emissions by more than 2.2 million metric tons annually, equivalent to taking over 492,000 cars off the road every year. Six awarded projects will also be paired with energy storage facilities, comprising 159 megawatts of utility-scale energy storage capacity that will enhance the integration of renewable energy resources onto the electric grid.

Cutting Costs for New Yorkers

The contracts include an index REC (renewable energy credit) structure to help cushion customers against potential spikes in electricity prices so that when electricity prices rise Tier 1 program costs go down. The average statewide bill impact for the typical residential customer will be approximately $0.13 per month once the projects are in operation. Total project costs, including a weighted-average all-in development cost of $63.08 per megawatt-hour, further demonstrate that land-based renewables yield competitively priced renewable electricity resources with critical benefits toward the achievement of the state's goals. NYSERDA payments under these awards will begin once projects have obtained all required permits and approvals and become operational to power New York.

These newly awarded projects will add to New York's robust pipeline of large-scale renewable electricity projects moving towards operation, comprised of over 120 solar, land-based wind and offshore wind projects under development that will deliver over 14,200 megawatts of clean power to the grid when completed - enough to power nearly five and a half million New York homes. The State's commitment to building out new green energy transmission, led by 250 miles of new major upgrades already underway throughout the state, with recently announced Clean Path New York and Champlain Hudson Power Express green energy infrastructure projects, will allow the current pipeline of renewables to power over 66 percent of New York's electricity from renewable sources once operational. ♻

2022 Community Inspiration Winner: SOLAR STEP BY STEP

Sam Saltonstall

The Neighborhood UCC in Bath, Maine is the 2022 winner of the Community Inspiration category of Interfaith Power and Light's (IPL) Cool Congregations Challenge for its persistence in successfully persuading the city to update its land-use code to allow solar installations in the historic district of their community.

In 2015, we sold our old place of worship and purchased a small steakhouse in the downtown where we could both worship and use the commercial kitchen to help us feed the food-insecure. The building was heated with propane but had a perfect south-facing orientation for solar, and we wanted to reduce our use of fossil fuels. We were inspired to serve as a visible role model for our community, and for that reason wanted to acquire a rooftop solar PV system rather than join a distant community solar farm.

Maine Solar Solutions installed an 8kW rooftop array atop The Neighborhood UCC in Bath, Maine. (Photos Sam Saltonstall)

We knew we must make the building more energy efficient and electrify our heating system to sensibly realize our solar hopes, but there was no money in the budget for energy improvements. A leaky rubber membrane on the flat portion of the roof had failed and needed immediate replacement. A search for the source of the leak led to the unhappy discovery that when the steakhouse owner added the pitched roof to what had been a flat-roofed gas station, he added no attic insulation. We needed an energy audit, but there was no money for that either. The path to solar would require a series of small steps to be undertaken one at a time as we raised the money to pay for them.

In April 2020, we discovered that the land use code forbade solar visible from the street within the historic district where we were located. We would have to get the code changed to realize our goal. Solar success suddenly seemed doubtful.

Back to 2017, we set about raising money ($1,300 for the roof repair, $450 for the energy audit capably performed by Topher Belknap of Green Fret Consulting). Our sexton sealed air leaks identified during the blower door test with inexpensive caulk. A team of church volunteers blew 14 inches of cellulose insulation up into the attic ($1,700). We inventoried and upgraded our lights, built and installed insulating window inserts, and continued to raise money with concerts, a plant sale and a silent auction. By 2019 we had enough to install a Fujitsu mini-split air source heat pump capably supplied by North East Heat Pumps ($3,900). We were electrified!

It was time to face the solar challenge. We had already spent about $7,500, but the solar estimate was almost $23,000, more than three times as much as we had already raised. What to do? We managed $3,000 of additional fundraising and a $4,400 solar bequest arrived, then found four generous individuals willing to lend us the $15,000-plus needed. But when our contractor went to pull the electrical permit, we discovered the zoning problem.

Determined, our solar team submitted a zoning code amendment for approval. The Planning Board did not like our first attempt but passed our second one on to the City Council. They tabled it, sending it back. The Planning Board's third wording attempt passed the Council unanimously, and on September 20, Maine Solar Solutions installed and turned on our new system. Hooray!

While it is too early to know the reduction in CO_2 emissions or the savings we will harvest, we believe that over the five-year term of the loans the church will see about $9,000 in reduced electricity costs from the 8kW array of 20 Solaria 400-watt black panels. The bulk of our energy will be sourced from the solar system, which has a modeled annual output of 10,076 kWh per yr. By applying the savings to paying the loans back, we should only need to raise an additional $1,550 annually for five years, after which we are home free. An online auction last fall netted $2,370 and may become our go-to annual solar fundraiser.

Meanwhile, the change in the land use code makes it possible for others within the historic district to install properly sited solar arrays visible from the street. Without the initiative we took, this would not be possible. We had persuaded the City Council to not only treasure Bath's past but to also support its clean energy future in a very specific way. Our step-by-step success has led to a heightened sense of confidence within our faith community, confidence that can lead to further efforts for the common good.

It was the urgency of the climate crisis and the knowledge that local mitigation efforts undertaken quickly are of critical importance that motivated our effort. And it was patience, persistence and the smart decision to borrow money from four individuals closely connected with the church that led to our success.

Members of The Neighborhood United Church of Christ proudly display the rooftop solar after overcoming zoning and financial obstacles.

Sam makes his home in Brunswick ME, where he is a Citizens' Climate Lobby Chapter Leader, led the charge to get solar up on his faith group's roof, and is Co-Coordinator of WindowDressers' Brunswick Community Build. Sam is winner of the 2021 Natural Resource Council of Maine People's Choice Award. ♻

UNIVIX POWER SOLUTIONS

Made in Laconia, New Hampshire

George Harvey

In May, we got an announcement from Chris Milner, CEO of Univix Power Solutions saying that the company was ready to do business, after a lengthy delay due to Covid-19. Univix is based in Laconia, New Hampshire, which means it is of local interest for most of the readers of Green Energy Times. It should be of interest to people all over the country because of the energy storage technology it offers.

The Unix Power Solutions team of (left) Ben Milner, director of sales; rt: Chris Milner, CEO; kneeling: Vince Kerns, production manager. (Univix Power Solutions)

Univix started up as a design challenge in 2018. To meet that challenge, it had to achieve five goals and produce a battery system with these characteristics:

1. Easy to install
2. Easy to use
3. 100% recyclable
4. Affordable for ordinary people
5. Powerful enough to run everything needed in an emergency

As hard as it might have been to accomplish these things, they were met in time for Univix to start up in January, 2020. Unfortunately, that was not a good time to launch a business, because that was when everything was just shutting down under Covid-19 restrictions.

Fortunately, Milner and Univix were able to ride out the pandemic, and the project is under way again. There have also been some technological improvements recently, which were incorporated into the product.

Univix is selling a battery storage system that is really different from anything else we have seen on the market. It incorporates nearly everything needed so it can be put into a building and hooked up. And it does this in a simple way that does not require a computer expert to understand.

Milner's announcement says, "We are one of the first to bring carbon batteries to the USA. To put this all-in perspective, we are twice as powerful as the closest competitor, but we're half the cost!"

The carbon batteries address two of the goals, cost and recyclability. To store the same amount of energy, they are far less expensive than lithium batteries, and Milner points out that they are 100% recyclable.

We should look at what the Univix carbon batteries are. They are basically the same as the old AGM batteries that have been around for many years, except for two things. One is that there is carbon in the electrolyte. The other is that the plates are not made of lead; they are made of carbon composite.

Milner is careful to point out that a number of other companies offer "carbon" batteries, meaning that carbon has been added to the electrolyte. The carbon plates mean that Univix batteries are of a different type, in which carbon prevents dendrites from growing on the plates. This means that the Univix batteries can last as long, through as many charge cycles, as lithium batteries.

The Univix system uses a transformer-based inverter, instead of all digital circuits. This has a number of advantages, including an ability to deliver power for sudden increases of demand, such as when a household pump comes on. And this, in turn, makes the Univix bank kinder to all the other equipment in the household that could be damaged by a momentarily insufficient power supply.

The transformer system does mean that the Univix system weighs a bit more than some other batteries. This is addressed by making it a floor-mounted system that is brought in on its own powered wheels, instead of being wall-mounted. And this, in turn, means that the Univix batteries can be installed quickly by one electrician, rather than requiring a lengthy installation by a crew.

The Univix system can work for grid-tied battery backup but will work just as well off-grid, which the competing systems will not. It can be charged by solar power and other alternative sources, and according to Univix, it works seamlessly with the new Enphase Microgrid system.

In terms of price, the Univix Bank, its flagship system, costs about half as much installed as the leading competitor. The warranty period is the same, and they should last as long. Part of the difference, as we have seen, is that the Univix system is more versatile, as it can be used off-grid. But some people will find another difference more important. Where the leading competitor will provide 14.5 kilowatt hours in an emergency, the Univix Bank will provide 18.2. In terms of installed price per available energy, the Univix system only slightly more is less than half as much, making it a better system at not much more than half the price.

One final thing to point out is that the Univix Bank is made in New Hampshire of parts that come predominantly from American sources.

The Univix website is univix.com. ♻

Univix carbon battery storage units are powerful and low cost. They work for grid-tied and off-grid electricity systems. (Univix Power Solutions)

What's Missing from Our Approach to Solving Climate Change?

Our Politics and Our Assumptions Are Not Helping Us

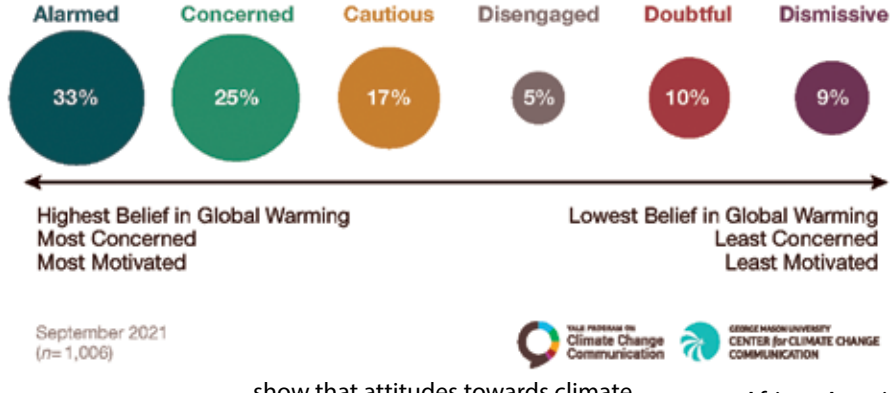
Bob and Suzannah Ciernia

Six Republican members of Congress addressed a Conservative Climate Conference this past March and told attendees that their voices are an important part of the discussions of climate change. Collectively, the speakers expressed the opinion that climate change is a significant threat to the planet and encouraged the audience, made up of conservative climate activists from Citizens' Climate Lobby (CCL), to continue to speak up (https://bit.ly/CCLConservativeConference).

Rep. John Curtis (R-UT) noted, "When I came to Congress, I did not have my climate feet underneath me. And the CCL in Utah reached out to me ... there was no judgment, there was no criticism, there was only encouragement and explanation and understanding. So let me just say that one of the reasons I'm here, I do what I do, is because of my relationship with CCL Utah. I know my fellow conservatives, I know my fellow Republicans, care deeply about this earth, but they're being painted and branded as if they don't care, as if they somehow deny the science. There are some of them in that category, but not the vast majority."

And for those who think that calling or emailing their representative about climate change is pointless, Rep. Nancy Mace (R-SC) had this to say, "I ask for this report every day — who's calling? What are they calling about? What are the emails? […] Knowing what people care about and where they stand on an issue is also very important. Those phone calls, those emails, those letters, they do make a real difference. So that advocacy work is important."

There's a good reason Republicans are talking more about climate change. Recent results from the Yale Program on Climate Change Communication clearly show that attitudes towards climate change are shifting, as demonstrated in this excerpt from their September 2021 study: "Americans who think global warming is happening outnumber those who think it is not happening by a ratio of more than 6 to 1 (76%* versus 12%). Those who are "very" or "extremely" sure global warming is happening outnumber those who are "very" or "extremely" sure it is not by about 8 to 1 (57%* versus 7%). The full report can be found here at https://bit.ly/YaleProgramonClimateChangeCommunication.



Moreover, in another report from the same organization, surveys found there are segments of the population that are often ignored or overlooked which make up the highest proportion of concerned Americans.

"We find that Hispanics/Latinos (69%) and African Americans (57%) are more likely to be Alarmed or Concerned about global warming than are Whites (49%). In contrast, Whites are more likely to be Doubtful or Dismissive (27%) than are Hispanics/Latinos (11%) or African Americans (12%)(https://bit.ly/YaleProgram_RaceandClimateChange)."

In other words, there are a lot of people concerned about climate change that may not be the first to come to mind when one hears the term

Cont'd on p.23

No Need to Worry About Lithium

George Harvey

We have new technology to extract lithium from sea water at low cost. (Silas Baisch, Unsplash, bit.ly/3Mgzei5)

As *Green Energy Times* publishes about the things that we need to do to save the planet, we often cover batteries. Whether they be for grid energy storage, household resilience, or electric vehicles, the need for batteries is real. And right now, much of that need is met by batteries containing lithium.

We at *G.E.T.* are very much aware that that some people are concerned about a possible lack of sufficient lithium to build all the batteries we need. We are also aware that some lithium batteries have been made using cobalt, which has come from mines where children were exploited for mining.

Our observations about these concerns are that (1) there is plenty of lithium, which is cheaply available and doesn't require building mines; (2) we don't need any cobalt to use lithium in batteries; (3) there are many ways of storing electricity that don't use lithium at all; and (4) more technology is coming.

Let's look at each of those statements.

1. Actually, there is plenty of lithium, and it can be found in numerous sources.

Some current sources of lithium are open pit mines in Australia and China. But they are limited in what they can produce, and mining should not be necessary.

Lithium can be extracted from brine in some areas. A single source in the Salton Sea, in southern California, is judged to be able to supply all foreseeable needs for the United States for several decades, according to a news report published by Lawrence Berkeley National Laboratory (LBNL). The report, "Quantifying California's Lithium Valley: Can It Power Our EV Revolution?" was published in February of 2022 (https://bit.ly/GET-lithium-1).

The lithium at the Salton Sea can be extracted at geothermal plants that were built to generate electricity. There are eleven such plants in the area. According to the LBNL paper, "The potential size of the lithium resource at the Salton Sea is staggering. Governor Gavin Newsom recently called California the 'Saudi Arabia of lithium,' and the state established the Lithium Valley Commission last year to research and write a report on the opportunities." And remember, this is just taking advantage of water already flowing through facilities that are already in place to produce renewable energy.

Does that sound like there is enough? In case it doesn't, there is more to the story. Lithium can be extracted from sea water very cheaply. And any country with a seacoast has a fair amount of that.

If scientists in the past had been told how extracting lithium from seawater would be done, they would probably have said it was impossible. The problem is that it is done essentially by filtering dissolved substances to separate them. While that technology did not exist in the past, it has been developed and can be used to extract lithium.

Getting the lithium from seawater starts with methods that bring sodium, magnesium, and potassium with it. That much was well known in the past. But in June of 2021, a method of separating out the lithium, leaving the other elements behind, was published in the journal *Energy & Environmental Science*. This was widely reported at the time, for example at mining.com (https://bit.ly/GET-lithium-2).

The method of separating out the lithium is to use an electrochemical cell containing a ceramic membrane made from lithium lanthanum titanium oxide. It happens that this substance has tiny pores will allow lithium atoms to pass through, but they are too small to allow sodium, magnesium, or potassium atoms through. The membrane is used indefinitely, so there are not many issues about its constituents.

The process is driven by electricity, which will cost about $5 per kilogram of lithium, but it also generates hydrogen and chlorine, both of which can be trapped and sold, offsetting the cost of electricity.

This means that we can extract a huge multiple of the amount of lithium we need at low cost.

2. There really is no need to use cobalt in batteries.

The original lithium-ion batteries produced by Tesla and other companies had cobalt in them, but Tesla has been switching to lithium iron phosphate batteries, which are referred to as LiFePO4 or LFP batteries. These and other forms of lithium-based batteries need no cobalt. In fact, they also do without nickel.

Beyond mud volcanoes, a geothermal plant is operating at the Salton Sea in California. Eleven of these plants are already generating electricity, and possibly all of them could produce lithium without major modifications. (Chris Hunkeler (bit.ly/3x5bjwy), CC-BY-SA 2.0 (bit.ly/3Nn399B)).

3. There are many more ways to store electric energy than we can mention here.

Some of them are batteries, and some are not. Some of the batteries are really impressive. Here is a partial list:

- Flow batteries are in use and becoming more common. They are entirely different from what is used in a home or car, though there are companies that are experimenting with them for automotive use. They use a number of different chemistries. An article on flow batteries appears at Wikipedia (https://bit.ly/Flow-battery). We also covered this at *G.E.T.* in an article on the Agora Energy Technologies flow battery (https://bit.ly/3al8DDa).
- Many other battery types are in the works. For example, metal-air batteries are coming into their own. In one case, an iron-air battery is being developed by Form Energy in Somerville, Massachusetts. Its components are water, rust, and air. As the battery is charged, the rust is turned to iron. Discharging the battery turns the iron back to rust. The cost of the electricity from this method of storage is projected to be 10% of the cost of electricity from lithium-ion batteries. Also, since the raw materials are so inexpensive, it is not hard to produce a 100-hour supply. The first grid battery based on the technology is set to be operating in Minnesota in 2023, supplying Great River Energy with 300 megawatts. An article on this appeared at *CleanTechnica* in July of 2021 (https://bit.ly/GET-lithium-3).
- But of course, we really don't need batteries at all for some applications. Pumped-hydro storage is the most important system we have so far, and has been around for nearly a hundred years. Also, *G.E.T.* recently had an article on energy storage, "New Technology for Energy Storage," which deals with a number of different new approaches to the storage problem, including such things as the cryogenic system being built by Highview, here in Vermont (https://bit.ly/GET-lithium-4). Also see the article about the Univix battery on page 14 of this issue.
- Indeed, many billions of dollars are being invested in hydrogen storage, which shows some promise as a way to fuel grid storage and electric vehicles with fuel cells and no batteries at all.

4. And finally, the problem of energy storage is the subject of huge amounts of research.

Many scientists are devoting large parts of their work to better storage, and their efforts are announced regularly.

Putting this all together, it might be safe to believe that supplies of lithium shouldn't be a problem, so don't let the idea of a shortage of lithium hold you back. ♻

Record Renewable Capacity

Cont'd from p.3

gas may already have peaked. New natural gas plants are not coming online as fast as they did two years ago, and with old gas plants retiring, the capacity is not increasing by much at all. According to the Federal Energy Regulatory Commission (FERC) 20,571 megawatts (MW) of natural gas generating capacity were added in 2018, but the amount fell each year to 5,489 in 2021. So far this year, barely any natural gas capacity has been added in the U.S. FERC's data on generating capacity can be found on a month-by-month basis at https://bit.ly/FERC-papers under the Energy Infrastructure column.

In terms of percentage of generated output, natural gas has not increased much at all despite its growth, going from 44.11% in 2018 to 44.16% in 2021. The reason for this is that huge amounts of solar and wind power have been added each year, and though natural gas use has increased, it has not changed much as a percentage of the total. Also, since consumption of natural gas is no longer growing quickly, and use of coal has declined, from 22.23% in 2018 to 18.49% in 2021, the consumption of fossil fuels has been falling overall. Nevertheless, there was a recovery in the amount of energy produced from fossil fuels in 2021, as the economy increased after the 2020 slowdown and demand for energy increased. Data on generating electricity comes from the Energy Information Administration (EIA) and can be found at https://bit.ly/EIA-monthly-data.

We might note that the data from the EIA shows that the output of U.S. nuclear plants has been falling slowly, as reactors have been shut down. Also, hydropower depends on weather, going up in wet years and down in droughts, but it is not growing or declining much.

Renewable energy

Wind power accounted for 7.94% of our electricity in 2018, but it has been growing quickly. It surpassed both hydropower and nuclear in 2020 and produced 10.68% of our electricity in 2021. Wind capacity rose from 94.95 GW in 2018 to 130 GW in 2021, for a growth rate of nearly 12% per year over three years.

It is solar power that really stood out over the time, however. In 2018, the U.S. solar power capacity was 35.82 GW; that rose to 67.78 GW in 2021. That is an annual growth rate of a bit over 23%. (Please note that we are only counting utility-scale installations, and the actual figures for solar power might be 40% higher when smaller systems are included.) The percent of our capacity that was utility-scale solar rose from 2.99% to 5.44% over the three years of 2018 to 2021.

All forms of utility-scale renewable electricity production increased in 2021 with the single exception of hydroelectric power, which has declined due to the drought in the West. EIA data shows that for the first quarter of each year, solar power increased from 16,370 megawatt-hours (MWh) in 2020 to 21,410 MWh in 2021, and 29,097 in 2022. The EIA estimates of solar power for the first quarter of each year with smaller systems included shows an increase from 24,252 MWh in 2020 to 30,696 MWh in 2021 and 40,522 MWh in 2022.

We received a note on installations in the U.S. for the first quarter of 2022 from the SUN DAY Campaign at the end of May. According to SUN DAY, 97.4% of all electric generation additions made in the first quarter of 2022 were renewable resources. Also, 24.4% of the electricity generated in the first quarter came from renewable resources. Both of these figures are new records (https://bit.ly/SUN-DAY-MAY-2022). ♻

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.

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

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

• Coal Change-out adder. Up to $7,000 additional incentive for a pellet heating system if replacing a coal heating system. Businesses can get up to an additional $27,000 incentive. Details at www.rerc-vt.org or call (877) 888-7372.

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

In Rutland & Bennington, & NEK Counties (and towns in neighboring counties that boarder Rutland Co.), contact Melanie Paskevich mpaskevich@nwwvt.org at NeighborWorks of Western Vermont, (802) 797-8610 on incentives for wood stove change-outs, energy audits, and weatherization.

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.

• GMP rebates available through December 31, 2021

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.

• More info on the 2021 IRS Tax form at https://www.irs.gov/pub/irs-pdf/f3468.pdf

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

• Ground Source Heat Pumps: up to $2,100/ton rebate

• 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.

Other Opportunities to Save

• Home Energy Loan – finance up to $20,000 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.*

Vermont's GMP Extends Rebates Through 2022

Green Mountain Power (GMP)is extending its popular rebate programs through all of 2022 to help more customers save money while reducing carbon emissions.

In 2021, GMP customers saved with more than 7,000 rebates when they made the choice to switch away from fossil fuel at home and on the road – for heating, driving, mowing their lawns, and electric motorcycles. Rebates include a $1,500 rebate on all electric vehicles, plus an extra $1,000 for low- and moderate-income customers, and a $400 base rebate on cold climate heat pumps with an extra $800 in incentives for income-eligible customers in partnership with Efficiency Vermont.

The Vermont Natural Resources Council (VNRC) cut costs with GMP incentives while completing the renovation of a historic house in Montpelier to serve as new office and expanded meeting space.

"One of our goals was a net-zero building, and GMP's incentives were a huge help in swapping out an old, inefficient oil-burning boiler for cold climate heat pumps," said Brian Shupe, VNRC's executive director. "GMP's incentives also helped us install an electric vehicle charging station to help staff and visitors convert to electric vehicles."

In 2021, the rebates and customized projects with business customers around the state will offset more than 173,000 metric tons of lifetime carbon emissions – the equivalent of taking 38,000 gas-fueled cars off the road.

Learn more about GMP's rebates on electric vehicles and charging at www.bit.ly/GMP-rebates-2, and heating and yard care at www.bit.ly/GMP-rebates-3.

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Department of Energy

NH DOE: All of NH DOE's programs, save the Residential Solar Water Heating Rebate Program are now OPEN.

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: https://bit.ly/NH-DOE_CommercialIndustrialSolar or at (603) 271-3670.

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 lev-

While we try to keep things up to date, incentives are always changing. Please be sure to check with the appropriate sources provided for the latest information.

els 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 https://bit.ly/NH-DOE_ResidentialRenewableEnergy***

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. https://bit.ly/NH-DOE_CommercialIndustrialWoodPellet

Residential Wood Pellet Boiler/Furnace

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

Contact: https://bit.ly/NH-DOE_ResidentialWoodPellet 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 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 www.bit.ly/GET-NH-4 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

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.
- NY homeowners are eligible for a 25% State tax credit up to $5,000 plus $1000s in additional incentives from their utility provider.

National Grid: Electric Vehicle Charging Station Make-Ready Program

- National Grid will do an analysis of your business or municipality to evaluate installing EV stations and accessing the type of EV needed for your fleet. Learn more information from their website: (https://bit.ly/NG-EV-MakeReadyProgram)

Check out your local utility's website for was to save more on your energy-efficient projects:

- **National Grid:** https://ngrid.com/3H7hBPU
- **Central Hudson**: https://bit.ly/CENHUD_SaveEnergy
- **NYSEG**: https://bit.ly/NYSEG_SaveEnergy
- **PSEG Long Island:** https://bit.ly/PSEGLI_SaveEnergy
- **RG&E:** https://bit.ly/RGE_SaveEnergy

MAINE

EFFICIENCY MAINE

All incentives and rebates are subject to change without notice. For information on Efficiency Maine's programs go to efficiencymaine.com or call 866.376.2463

Home Insulation: Efficiency Maine offers weatherization rebates up to $9,600 for income-eligible homeowners and up to $5,500 to other Mainers. See bit.ly/EffME_HomeInsulation. Residents can estimate home energy efficiency with the calculator at bit.ly/EffME_SavingsCalculator. To find a vendor go here: https://www.efficiencymaine.com/at-home/vendor-locator/.

Heat and Cooling: Efficiency Maine offers rebates and financing for installing high-efficiency heating systems. To find out more, see bit.ly/EffME_HeatingSolutions. For business solutions see bit.ly/EffME_BusinessHeatingSolutions. Homeowners can estimate annual heating costs for different heating systems using the calculator at bit.ly/EffME_HeatCostComparison.

Heat Pumps: Residents of any income are eligible for heat pump rebates up to $1,200. Income-eligible residents qualify for rebates up to $2,400, and businesses are eligible for incentives up to $4,800. Learn more at the Efficiency Maine heat pump website, bit.ly/EffME_HeatPumps.

Heat Pump Water Heaters: Efficiency Maine offers $850 mail-in rebates or instant discounts on heat pump water heaters. Learn more at bit.ly/EffME_WaterHeatingSolutions. A Water Heater Cost Calculator to estimate savings is at bit.ly/EffME_WaterHeatingCostComparison.

Electric Vehicle Charging Solutions: Charging at a single-family home is convenient and inexpensive. Most EV drivers do over 80% of their charging at home using either a Level 1 charger cord or a faster Level 2 charger. For public sites or multi-family residential sites, installing EV charging can increase employee satisfaction, show sustainability commitments, strengthen relationships with customers and attract new ones. See bit.ly/EffME_Work_EVCharging.

Electric Vehicles (EVs): Efficiency Maine offers instant rebates for eligible battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) at participating Maine car dealers. Learn more at https://www.efficiencymaine.com/ev/.

The standard rebate is $2,000 for a BEV and $1,000 for a PHEV. Higher rebates are available for low-income customers, governmental entities, and select nonprofits. For a limited time, Efficiency Maine offers a promotion for businesses with five or more vehicles registered in Maine, paying rebates of $4,500 on a BEV or $3,500 on a PHEV for the first 50 vehicles on a first-come, first-served basis. Maine businesses can also receive up to $8,000 for the purchase of an all-electric commercial van for business use. See bit.ly/EffME_EV_Rebates.

Commercial: Efficiency Maine has programs for businesses of all sizes, some multi-family buildings, and Maine's largest energy customers. Examples of eligible organizations include businesses, for-profit or non-profit; municipalities; education facilities; manufacturing and industrial facilities; other non-residential facilities; and residential buildings with five or more units. To learn more about Efficiency Maine's incentives for any of these, visit bit.ly/EffME_AtWork.

Appliances: $50 rebates available for ENERGY STAR® certified clothes washers: bit.ly/EffME_ClothesWasher_Rebate

Room Air Purifiers: $25 rebate available for ENERGY STAR® certified room air purifiers: bit.ly/EffME_AirPurifier_Rebate.

Hannaford Commits to 100% Renewables by 2024

Jessie Haas

Hannaford Supermarkets, based in Scarborough, Maine, has announced a plan to be fully powered by renewable energy by 2024. The announcement was made in April, in recognition of Earth month.

Hannaford has been working since the beginning of the decade to reduce energy use in its stores, using efficiency techniques such as installing LED lights, night shades, doors on refrigerated cases, and state-of-the-art refrigeration systems. The supermarket chain already uses 30-percent renewable energy, by partnering with over 30 community solar projects across Maine, Massachusetts, and New York and has converted 86.4MW of its electricity usage after efficiency upgrades to solar. It has rooftop solar on ten of its 184 stores. Hannaford will fully convert to solar by integrating community and large-scale solar projects in Maine and New York.

George Parmenter leads sustainability efforts for Hannaford and says the chain "has always been serious about sustainability—and over time, it's become an integral business function. But there is a sense of urgency as we witness the planet in the midst of a climate crisis. Hannaford wants to lead where we can to make the most impact—and renewable energy is just another step in our journey."

Other steps taken by Hannaford in the past include: becoming the first grocery retailer in the country to introduce reusable bags; building North America's first LEED Platinum supermarket, in Augusta, Maine, in 2009, halving the energy usage for grocery stores of its size; installing a first-in-the-nation refrigeration system using natural refrigerant that is environment-friendly and which earned Hannaford a "Best of the Best" award from the EPA's Green Chill Partnership in 2013; introducing and expanding EV charging stations in store parking lots for a total of 163 plugs and 31 stores and counting.

Hannaford's Cony Street store in Augusta, ME is North America's first LEED Platinum supermarket with solar on the roof. (James Helms, Hannaford's multimedia specialist)

In 2021, Hannaford became the first large-scale grocery retailer in its marketplace to achieve zero food waste, by donating or diverting all food at risk of going to waste. It is the first large retail grocer in the Northeast to meet that goal. The company first focused on strategic ordering and management at stores to prevent over-buying. Employees learn how to handle food to avoid damage and exposure to temperature variation. Each store follows the U.S. Environmental Protection Agency Food Recovery Hierarchy, which prioritizes donation to food-insecure people, then local farmers, and finally food-to-energy conversion.

According to the EPA, up to 40% of all food in the United States is wasted and ends up in landfills, where it becomes a potent generator of harmful methane gas. Reducing food waste is the number three solution identified by Project Drawdown for reversing global warming. In its effort to move toward zero waste, Hannaford donated over 25 million pounds of food to hunger-relief agencies in 2020 alone. The company recycled 101 million pounds of cardboard and 3.3 million pounds of plastic in 2020. It diverted 32.7 million pounds of food waste to biodigesters to create clean energy.

One hundred percent of the seafood sold at Hannaford stores comes from sustainable sources. The company says, "Hannaford will only sell products harvested using legal methods in regulated environments and encourages our suppliers and the fishing community to invest in gear and farming technologies that reduce adverse seafood production impact on the environment. We have an extensive program and work proactively with reputable groups." These include the Gulf of Maine Research Institute and the Global Aquaculture Alliance.

Hannaford's sustainability commitment has received praise from national leaders. Maine senators Susan Collins and Angus King noted in a joint statement, "The effects of climate change are evident across our state and have serious implications for the livelihoods of Maine people. Hannaford's commitment to using 100 percent renewable power by 2024 will provide a boost to community and large-scale clean energy projects as well as help protect our environment."

Congresswoman Chellie Pingree (D-Maine) chairs the House Appropriations Subcommittee on Interior and Environment and is Vice-Chair of the Sustainable Energy and Environment Coalition. She said, "(Hannaford's) commitment will put us closer to achieving net-zero emissions and creating a healthier, more equitable, and more resilient economy. I hope their pledge inspires other companies to embrace renewable energy and sustainable practices. Clean energy is the future, it is necessary, and it is the key to fighting climate change."

Hannaford Supermarkets operates 184 stores in the Northeast, in ME, NY, MA, NH, and VT.

Links available on the GET website.

Jessie Haas has lived in a tiny, off-grid cabin in Westminster, VT, for nearly 40 years, with husband Michael J. Daley. She is the author of over 40 books for children and adults. ♻

Winning the Energy War

Cont'd from p.1

day of replacement oil. The producers with the potential capacity to produce more are all on the sidelines. Iran and Venezuela face their own sanctions problems; Saudi Arabia and the UAE are seeking to sustain the very $100-plus per barrel price that would be the toxic fruit of an ongoing supply shortage; and U.S. shale producers prefer lower levels of production with higher prices to the risk of pumping all-out and seeing profits evaporate.

So, the pursuit of replacement crude by Europe will predictably fall short, leaving three pathways. Oil prices remain indefinitely intolerable; the embargo collapses or the world accelerates the substitution of clean energy for oil.

The oil industry's solution is for government to commit to even bigger subsidies, lease greater tracts of public land for oil and gas production, and weaken safety and emission standards for the industry. Remarkably, even in a global crisis, the oil industry through the American Petroleum has proposed nothing that could actually yield more oil or cut prices. Scott Sheffield, the CEO of Pioneer Natural Resources, an oil and gas giant, went on television to declare that there was no price– not even $200 a barrel – that would entice the industry to grow.

So, is the West doomed to lose the energy front in the struggle with Russia?

Certainly not in the long run. Even without shortages, if oil prices remain around $100, both governments and consumers will continue to embrace the swelling fleet of electric vehicles (EVs). The West will be joined by India and China, desperately seeking to avoid the exorbitant, growth-crushing costs of transport systems fueled by $100 imported oil.

But what about the short term? Is there really nothing the West can do to rebalance markets and cut prices? Fortunately, we are not helpless.

Systematically swept under the rug are a series of short-term policy initiatives that could almost immediately cut demand for Russian oil and gas, lower global energy prices and accelerate the world's shift from fossil fuels to clean energy.

Yet another weapon in the energy wars: electric vehicles. Above is a Tesla Model 3. (Martin Katler, Unsplash. https://bit.ly/3GRZFcM)

As two-thirds of EU oil is used in transport, accelerating the transition to EVs is the best way to sanction Putin's military ambitions.

Within the next year Europe could Immediately reduce demand for oil and gas through efficiency and clean energy. Cutting truck speeds, lowering thermostats on gas furnaces by 2º, and accelerating the replacement of furnaces with heat pumps would cut Europe's oil use in transportation by 11%. In only a few years, speeding up Europe's timetable for EVs, doubling growth targets for wind and solar, and eliminating permitting bottlenecks for renewables could save another 10% of oil plus a huge volume of gas.

There's more. Oil and LNG are traded in global markets. Demand reductions anywhere free up supplies and lower prices everywhere. Europe has recognized this in its futile pursuit of non-Russian sources of oil and gas. But demand destruction strategies adopted by Ukraine's global allies could make enormous difference.

Installing more roof-top solar, heat pumps and off-shore wind, could significantly cut the demand for LNG in Taiwan, Korea and Japan, freeing methane gas for the EU. The biggest vehicle fleet in the US, the Postal Service, could be fully electrified, eventually saving 500,000 metric tons of CO2. All of these oil and gas fuel replacing opportunities would accelerate if permit obstacles were systematically removed. An analysis by Energy Innovation shows that the oil-saving measures incorporated in the pending Build Back Better legislation would, by 2027, cut U.S. oil demand by an amount exceeding current Russian imports.

More broadly, Ukraine's allies can reduce Russia's supply chain power and revenue from commodities other than oil and gas. The U.S. imports a lot of Russian aluminum and faces significant future shortages of the metal as clean energy technologies grow. There are two recently shuttered aluminum smelters in the Northwest that could be reopened as the first step toward rebuilding US aluminum self-sufficiency. U.S. (and Indian, Brazilian and Australian) electro-metals processing capacity for batteries and renewables will be expensive at first, and then as capacity scales up, and markets grow, highly lucrative. Wartime urgency makes it much easier to invest in initially expensive but long-term profitable technologies as the U.S. showed when the space program birthed solar panels.

Finally, the world will soon be forced to respond to the looming food crisis, the product of two shortfalls: Ukrainian wheat bottlenecked behind the Port of Odessa and embargoed Russian fertilizer exports – while soaring gas and oil prices make additional fertilizer prohibitive. But nitrogen fertilizer can be made using green hydrogen. And right now, green fertilizer is actually cheaper than that derived from oil or gas. Why not seize this moment to commission the production of as many hydrogen electrolyzers for green ammonia plants as capacity permits – knowing that in doing so we will not only provide desperately needed food, but also drive down the future price of greening our fertilizer supply chain?

Campaigners could thus begin by embracing oil displacement strategies that reduce demand now when the economics of even expensive interventions is unequivocally favorable. The oil industry was betting its future to be turbocharged. Emerging importers like India, and new markets like plastics, were

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Flying with Electrons Over Vermont

Michael J Daley

BETA's electric aircraft, ALIA, flies over the Vermont mountains during a test flight. (Brian Jenkins/BETA Technologies)

What takes off and lands like a helicopter, flies like an airplane, emits no carbon dioxide or pollution, and looks like a bird? It's the Alia, a cutting-edge electric vertical takeoff and landing (eVTOL) aircraft being produced by Burlington, Vermont-based Beta Technologies. Aerospace engineer Kyle Clark, designer of Alia and founder of Beta, was inspired by the Arctic tern, a bird astonishing in its ability to fly long distances without landing.

Why the Alia caught this publication's attention will be no surprise to our readers: it's powered by batteries! Further, Beta intends to supply those electrons with renewable energy. With a 50-foot wingspan, the Alia is made of lightweight material, has four lift propellers and one rear pusher propeller, all-electric propulsion, travels 250 nautical miles on a single charge, has room for three standard pallets of cargo or five people, and can recharge in one hour. A trip from Burlington, VT to Brattleboro, the full length of the state of Vermont, would be no problem.

Alia is an expression of a vision to revolutionize not only aviation, but also intercity cargo delivery while fighting climate change. Not a bad agenda. Talented people from all over the world have been attracted by the call. Beta has grown from 30 employees to 350 in just five years. Over 90 job openings are presently posted on its website. Beta is attracting employees with deep backgrounds in aeronautics, former test pilots, and recently trained its first military personnel: the universal opinion seems to be that this is one exciting aircraft to fly.

If you live in the Lake Champlain area, you may have seen the elegant white aircraft swooping over the waves as it undergoes prototype development and flight testing while awaiting FAA approval for commercial operations. It's out there over unpopulated spaces just in case. Flight testing is going well, with no major mishaps reported.

Another core value of the company is to encourage all employees to learn to fly. Beta has over 20 in-house flight trainers and lessons are free. Asked if she has signed up, the Beta spokesperson mentions "a few rides" but has not started training--yet. "It's part of a core philosophy we have that everyone should get to fly. It's part of the team-oriented focus. The more feel everyone has for aircraft systems, the better the plane we'll design."

The excitement and enthusiasm of being involved in this revolution fills her voice as she answers this reporter's questions. She asked only to be identified as a Beta spokesperson because she did not want to bring herself too forward. Just four months into her job, she clearly reflects the team philosophy espoused by Clark, a former professional hockey player.

There's no singular genius, Clark explained to Thom Patterson in an April 25, 2022 *Flying Magazine* article. "Everybody on a team has a role, whether you're the headliner or a solid defenseman that nobody ever hears about. This is very close to home: I push away this notion that there's a singular genius that figures all this out and moves forward. It's a massive group effort of multiple geniuses, each in their own way putting it together."

Lately, Clark, Beta and Alia have been receiving lots of attention in various media from technical aviation, to finance, to the Sunday Business section of *The New York Times*. Deservedly so. The Alia is on track to receive FAA approval for commercial operation (expected in 2024) just a few years since development began – quite an achievement for a totally unique aircraft. *The New York Times* reports Amazon investing heavily in Beta through its Climate Pledge Fund. *Flying Magazine* reports the Alia is the first electric aircraft piloted by the U.S. Air Force in its Agility Prime military research program, and that Beta also has purchase agreements with UPS, Blade Urban Air Mobility and the biotech company United Therapeutics.

As related in the April 16, 2022 *New York Times* piece, "The Battery that Flies," the Alia represents the fulfillment of a dream for Martine Rothblatt, the founder of United Therapeutics, which makes human organs. As early as 2013, "Ms. Rothblatt wanted an electric heli-plane 'to deliver the organs we are manufacturing in a green way,' and fly them a considerable distance — say, between two mid-Atlantic cities. 'Every single person told me it was impossible.'"

Not until 2017 and a chance meeting with Clark at a conference did Rothblatt find someone who finally said, "I can do it." United Therapeutics supplied $1.5 million in seed money for Clark to get Beta Technologies off the ground, and the rest is soon to become aviation history.

Links available on the G.E.T. website.

Michael J. Daley is a life-long renewable energy educator and advocate, except for a brief time in high school when he though nuclear power was cool. He lives in a tiny off-grid cabin in Westminster, VT with his wife, Jessie Haas. ♻

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to be the growth engine of future crude markets.

To head off such growth, the next round of scaled investments in clean alternatives need to be supported. There has never been a more favorable time to get major emerging markets to solidly embrace an electric transportation future, especially for both passenger and heavy-duty vehicles.

The most effective strategies will take advantage of the cost reductions that come with greater deployment of clean energy technologies like wind, solar and batteries. Paying higher wartime prices for first generation decarbonization yields cheaper progress in the future, and actually yields cheaper energy than waiting for costs to fall before scaling.

But so far this logic does not seem grasped by policy elites on either side of the Atlantic. Perhaps President Zelenskyy should make a green energy speech asking his allies to stop wasting money and accelerating inflation by buying Russian oil and gas. He seems to have their ear.

A veteran leader in the environmental movement, Carl Pope is the former executive director and chairman of the Sierra Club. He's now the principal advisor at Inside Straight Strategies, looking for the underlying economics that link sustainability and economic development and serves as a Senior Climate Advisor to former NYC Mayor Michael Bloomberg. ♻

Solar at Antioch University New England

Kate Witte

In the fall of 2021, the Antioch University Board of Governors approved the installation of a 141kW ground-mounted solar array at Glover's Ledge in Langdon, New Hampshire. Glover's Ledge is an Antioch University New England-stewarded property used for outdoor recreation, student and faculty research, and biodiversity conservation. The decision to install solar was based on the need to provide research opportunities for students and faculty involved in sustainable development, as well as furthering our commitment to environmental sustainability.

Antioch University of New England in Keene, NH. (Courtesy image). Rt: ReVision Energy installed a 141kW solar array at Glover's Ledge in Langdon, NH. Glover's Ledge is a stewarded property used for outdoor recreation, student and faculty research, and biodiversity conservation at Antioch. (ReVision Energy)

At Glover's Ledge, trees on an acre of land were cleared for the construction of the array, and of that acre, less than half was stumped for the installation of the solar racking and panels. Trees on the perimeter of the area that were larger than fifteen inches in diameter were removed to maximize sunlight penetration. Although the site was an old gravel pit, it certainly seems counterintuitive for a property focused on ecological conservation, education, and research to convert a portion of the land that could grow forest to a non-forest use. However, the solar array is furthering Antioch's commitment to education and conservation. Data from the array will be displayed on a live monitoring feed. This provides an opportunity for students in sustainable development programs to work with raw solar data and expand their knowledge of alternative energy in real time.

As well as furthering student learning, the array is also helping Antioch with its commitment to ecological conservation by providing an opportunity for habitat restoration. Land within the cleared area, including the space between the rows of panels, will be seeded and planted as a pollinator meadow and open field. These ecosystems are beneficial for bees, butterflies, bats, and other pollinators. The cleared area on the edge of the forest will be maintained as early successional shrub-scrub habitat. The tall grasses, wildflowers, and shrubs that will grow will benefit numerous wildlife species particularly small mammals and unique songbirds.

Finally, this solar array is an important step in Antioch's commitment to mitigating the climate crisis. Solar energy is a virtually unlimited clean energy source that does not require fossil fuels. Carbon emissions from fossil fuels are responsible for much of the climate change we are experiencing globally. Solar farms and rooftop solar are in the top ten climate solutions according to Project Drawdown, the most comprehensive plan ever proposed to reverse global warming. This solar array is an important climate mitigation and educational tool, and Antioch is excited to be generating clean energy at Glover's Ledge!

Kate is a graduate student at Antioch University New England studying Environmental Education. She is the Education and Outreach Coordinator for Glover's Ledge and is passionate about connecting people to nature. ♻

Rational Cause for Optimism: Grid Modernization and Labor

Phil Coupe

Amid the noise, haste, and chaos of modern life there are more positive developments for humanity than one might think. Everyone focuses on the disasters of the climate crisis, and while those do motivate our daily work, we also feel it's important to highlight the hopeful – the very real innovations pushing our clean energy movement forward.

Greatest Opportunity Since the New Deal

Current events have drastically shifted global attitudes regarding the vulnerability of fossil fuel supply chains and the need for a rapid switch to renewable energy and clean technology. Russia's petro-fueled atrocities in Ukraine and Putin's threat to cut off natural gas supplies to western Europe have temporarily replaced the existential threat of climate damage as the number one motivation for nations to move away from coal, oil and gas.

"Beneficial electrification" is the somewhat wonky industry term to describe the massive societal shift from burning fossil fuels to zero-emission electric appliances powered by renewables and energy storage. Using rooftop solar panels to charge an electric car is a good example of beneficial electrification; as are solar-powered heat pumps to heat and cool your home. Both solutions are cleaner, cheaper, and far more sustainable than combusting hydrocarbons.

The solar industry needs hundreds of thousands of workers

America's aging utility "grid" is crucial to beneficial electrification because demand for electricity to charge EVs and power heat pumps is scaling rapidly. Plus, the poles and wires transmit electricity from where it is available to where it is needed, say from a large rural solar farm to urban consumers, or from storage facilities to consumers. To enable a complete societal transition to clean energy, we need a utility grid with four to six times more capacity than today's grid.

The solar industry needs hundreds of thousands of workers. (Solar pv photos courtesy of ReVision Energy)

This urgently needed grid upgrade is a colossal infrastructure project, of a similar scope as the buildout of our interstate highway system in the latter half of the twentieth century and the massive public projects of the New Deal in the 1930s, both of which required hundreds of thousands of workers and spurred powerful economic progress nationwide.

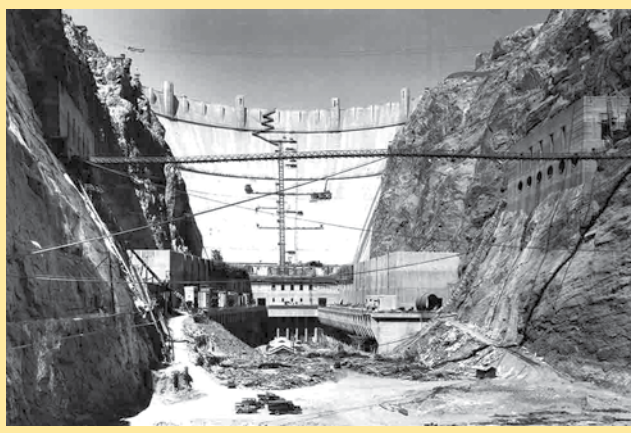
Achieving beneficial electrification at the household scale is now commonplace, but people are waiting months for their clean energy installations across the U.S. due to a severe shortage of skilled labor. At this moment when clean energy demand is skyrocketing due to high energy costs and war-mongering Russia, America does not have the necessary human resources to kick beneficial electrification into overdrive.

The multi-pronged solution to this labor problem includes education and recruiting, training and licensure, and making clean-tech jobs more attractive. For example, one way that ReVision Energy approaches this is through presentations to students at northern New England high schools, vocational schools, community colleges, and universities.

In the Past

During the Great Depression nearly a century ago, workers did not have the luxury of choosing what type of employer they wanted to work for. As the global economic system teetered on the brink of collapse, sowing unemployment, hunger and poverty throughout the world, workers were desperate for any kind of paying job.

As a result, psychological depression plagued many in the 1930's, just as it does today in the face of calamitous news about the war and climate damage. To save America and its citizens, President Franklin Delano Roosevelt launched a series of large-scale initiatives to resuscitate the economy and empower workers to earn a decent living. Among the many projects of this "New Deal" was the creation of the Tennessee Valley Authority (TVA) and the Hoover Dam, leading to vast quantities of cheap hydropower for the mid-Atlantic region and the southwest. Other infrastructure outcomes nationwide included the construction of 4,000 schools, 130 new hospitals, 9,000 miles of storm drains and sewer lines, 150 new airfields, 29,000 new bridges, 280,000 miles of roads, planting of 24 million trees and 700 new parks.



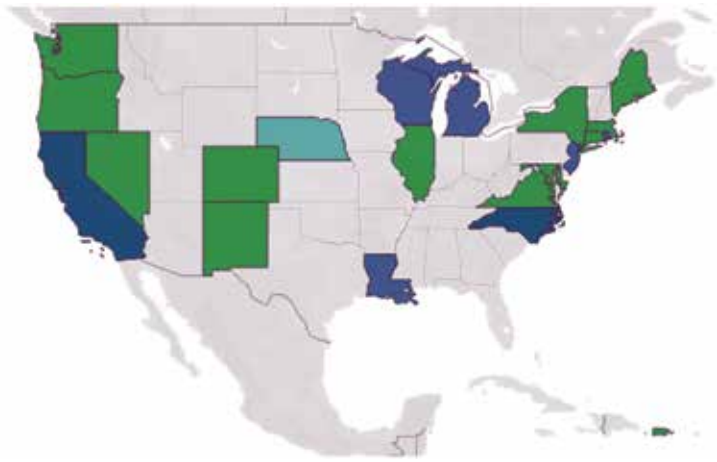
Construction of the Hoover Dam began in 1931 to 1936. (www.bechtel.com/projects/hoover-dam/#gallery-8)

After more than 150 years of fossil fuel extraction, transport, refining, distributing and combustion, America is overdue for a national beneficial electrification plan that addresses our skilled labor and grid modernization crises. Transitioning society to a clean energy future is the greatest economic development and job creation opportunity since the New Deal.

Phil Coupe is the co-founder of ReVision Energy. Learn much more at revisionenergy.com. ♻

More than Half of Americans Have a 100% Clean Energy Goal

The Clean Energy States Alliance (CESA) announced on March 25, 2022 that more than half of Americans now live in a state with a 100% clean energy commitment, a milestone that reflects rapid development in renewable energy across the nation. As the CESA Table of 100% Clean Energy States shows, a group of 21 states plus the District of Columbia and Puerto Rico now have 100% renewable energy or net-zero greenhouse gas emissions goals, and their population represents 51% of all Americans.



States that have adopted official zero-GHG or 100% renewable energy goals for their power sector or whole economy. Keep up with the status of other states at https://bit.ly/CESA_CleanEnergyStatesMap.

"States are leading the way towards affordable, clean, and secure energy for the nation," said CESA Executive Director Warren Leon. "It's time for Congress to act to ensure that those states are successful

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GLOBAL CLIMATE CHALLENGES

Dr. Alan K. Betts

Much is happening on a global scale as climate breakdown accelerates and new climate extremes are reached everywhere. Record temperatures in South Asia, reaching up to 120ºF, have made life desperate for millions in India, where few can hide inside with air conditioning. Spreading droughts are increasing wildfires. In the U.S., a large fire near Las Vegas has blackened 170,000 acres. It was a prescribed burn lit by the Forest Service that got out of control in a region of extreme drought! The NOAA drought map from May 3, 2022 showed large regions of severe to exceptional drought in the western U.S.

Very little is now under our control in both the natural and human worlds. Let us step back and start with the truth that sets us free, since the living Earth system, after waiting for decades for humanity to stop destroying the Earth for profit, is taking over the climate system. The creation and the living Earth system are inseparable from the truth that sets us free, even though this is heresy to human power, trapped in webs of lies. Everywhere we look, human society is lost in these webs of lies. These come from politicians, the fossil fuel empire, business-as-usual capitalism with its consumer growth model that is destroying the Earth, all the way to Putin's war based on lies that is destroying Ukraine.

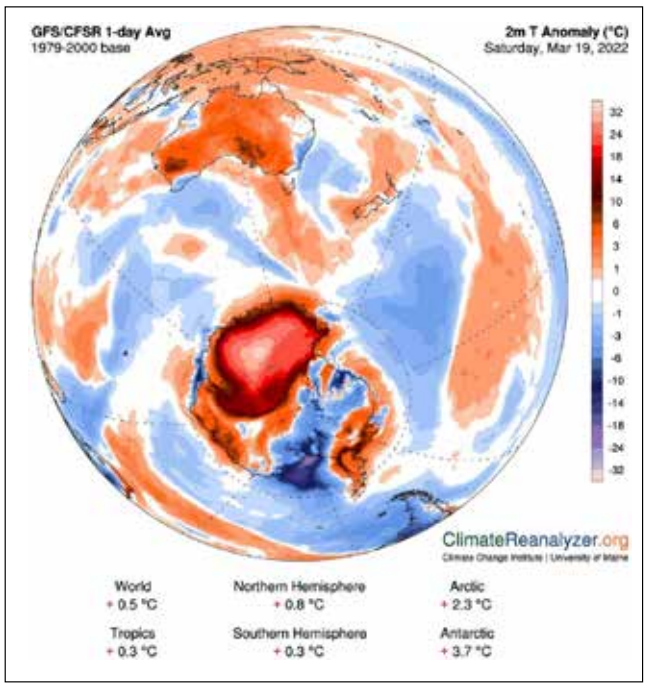
In the Vermont world, I have spent five months rescuing the West Haven Community Solar Array from bankruptcy, neglect and theft by the Clean Energy Collective a corrupt business that stopped maintenance and stole all the assets of the array.

Readers of G.E.T. will understand that truth and integrity are central to business, but few can see the many levels of deceit in our society. But in the climate world, the direct intervention of the living Earth system gives us no choice. We have to wake up fast, take a deep breath, dump the social webs of lies and cooperate with both the truth and the difficult reality ahead.

> "... the living Earth system, after waiting for decades for humanity to stop destroying the Earth for profit, is taking over the climate system."

The extreme stunning event in late March was in Eastern Antarctica. Our COP26-politicized world has believed that the melt of the vast thick cold ice-sheets of Eastern Antarctica was far into the future – maybe centuries. We can just go on making money for now! The Earth however is exploring how to deal with the human menace. On March 19, 2022, a new temperature record was set at the Concordia weather station on the East Antarctica plateau that was 70oF (40oC) above the 30-year climatology, just by sending warm air down from the deserts of Australia (see graph).

This was a shock to scientists who said: "If you had told me 3 days ago this would happen, we would never, never have believed you." For the first time a small ice sheet broke off from E. Antarctica. Overnight, we glimpse a new world, where a



20-to-30-foot global sea-level rise from the combined melt of the Greenland and Antarctic ice-sheets becomes a possibility in the next few decades. There is nothing we can do about it, except connect more deeply with the living Earth system, and reverse course at once. Note that the Antarctic is warming more than four times as fast as the Northern Hemisphere.

In Vermont in mid-May, temperatures went into the 80's. The speed of the transition has been stunning, as I was still watching out for frosts in early May! My spinach and lettuce wintered over under glass and a wide range of cool weather crops (peas, chard, kale, broccoli and brussels) are growing well. I have replanted potatoes, and yesterday I planted our summer and winter squash, since minimum temperatures in the next 10 days range from 40 to 60oF! Growing our own food is valuable, as the global commercial agricultural system is a many-sided disaster impacting forests, soil quality and generating methane to drive climate change. As commercial food exports from the Ukraine have been cut off, some have realized it would the wise for the peoples in Africa to shift back to the rich variety of indigenous foods they can grow themselves.

Everything is interconnected, including the latest lying political maneuvers to force women to have children they cannot support to keep our population of capitalist consumers growing to make more money and destroy the earth even faster.

It is better that we step into the sunshine and connect to the living Earth instead.

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

Do the Next Right Thing

John Bos

We are reaping the consequences of an interpretation of the words set forth in Genesis that God said "Let us make humankind in our image, according to our likeness; and let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth." (Gen.1:26 New Revised Standard Revision).

The United Nations' World Meteorological Organization (WMO) issued yet another grim report about the state of our planet in the third week of May. In 2021, four of the seven major climate indicators – a set of parameters that hold key information about climate change - set alarming new records.

In what the WMO said is a clear sign that humans are causing "harmful and long-lasting" effects across the globe, the report found that greenhouse gas concentrations, sea level rise, ocean heat and ocean acidification all set new records last year. The report also found that the past seven years have been the warmest seven years on record.

In a press conference about the findings, U.N. Secretary-General António Guterres said, "I will give you the bottom line – the global energy system is broken and bringing us ever closer to climate catastrophe. Fossil fuels are a dead end, environmentally and economically. The only sustainable future is a renewable one."

In the face of the planet's most defining challenge and a fast-approaching deadline to address it, what can people like us reasonably do? Noted environmentalist Paul Hawken sets out to answer this question in his new book Regeneration: Ending the Climate Crisis in One Generation, to be published in September.

In an interview, Hawken said, "I always suspected that there would not be widespread action until global warming became experiential instead of conceptual. That is increasingly so, and that has changed my thinking about how to communicate. Climate deniers are now completely irrelevant. Political corruption is the key obstacle, and it is a formidable challenge."

Asked what he means by 'regeneration,' Hawken said, "Regeneration means placing life at the center of every action and decision. I was asked to come up with guidelines or principles by a friend and in fifteen minutes this is what I came up with. Others can make their own guidelines. These seem obvious to me, and I think they are common sense to anyone who wants to create a meaningful life on this planet."

Hawken would have us ask ourselves a dozen questions. 1. Does the action create more life or reduce it? 2. Does it heal the future or steal the future? 3. Does it enhance human well-being or diminish it? 4. Does it prevent disease or profit from it? 5. Does it create livelihoods or eliminate them? 6. Does it restore land or degrade it? 7. Does it increase global warming or decrease it? 8. Does it serve human needs or manufacture human wants? 9. Does it reduce poverty or expand it? 10. Does it promote fundamental human rights or deny them? 11. Does it provide workers with dignity or demean them? 12. In short, is the activity extractive or regenerative?

Rev. Fred Small, former environmental lawyer, climate activist and Policy Director for Massachusetts Interfaith Power and Light. (John Bos)

These questions could all be embraced in five words: "Do the next right thing." I heard these five words spoken by climate activist, Unitarian Universalist pastor, singer-songwriter, and former environmental lawyer Reverend Fred Small at the All-Souls Unitarian Church in Greenfield, MA. Rev. Small is the Policy Director for Massachusetts Interfaith Power and Light which mobilizes people of faith to become climate activists. I had attended his service on May 8, because I was down in the dumps, not only about our climate crisis, but the abysmal state of our country and the world at large.

Small nailed it for me when he said, "From the coronavirus to the ecological crisis, from structural racism to rising authoritarianism, the obstacles before us can feel overwhelming, and it's hard to know what to do or ever where to begin." Amen, I thought to myself.

But then he continued, "Lately, I've found comfort and strength in the maxim 'Do the next right thing.'" Another Amen, this time heartfelt. "Do the next right thing" cleared away the too many actions I felt I should be taking that were cluttering my mind, energy and emotions. Through this lens I find myself very much attracted to Paul Hawken's twelve questions. Each of his questions can apply to every single action I might take. Just asking one of them - and really listening to that question - can guide what I do.

The next step is to do it.

John Bos is a contributing writer for Green Energy Times. *His column Connecting the Dots appears every other Saturday in the* Greenfield Recorder. *He is the editor of a newly released children's book* After the Race. *Questions and comments are invited at john01370@gmail.com.* ♻

Podcast Review:

APOCALYPSE CREEP

This American Life
Review by Victoria Ines

After listening to the first part of the podcast "*Apocalypse Creep,*" I wanted to believe it was one of those dystopian, fictional narratives designed to emulate a low-drama real-life scenario. *Don't Look Up*, for instance, was written to provide people with a faster-moving version of climate change. Part of me knew that it wasn't, of course. But I found some of the stories described in the podcast so outlandishly terrifying that I simply wanted to believe that they weren't real.

The podcast begins innocuously enough. A recording of a California fishing report plays, with the "This American Life" host Ira Glass interjecting every so often to provide an explanation or comment on the report. However, as time passes, the reports progressively get odder and more alarming. In one August report, the man in the recording, Dondo Darue, suggests that fishers keep a thermometer handy to check the temperature of the water before fishing. In another, he reports that all of the national forests in California have closed. Very few people were around to hear the latter announcement though, since nearby fires had forced people to evacuate the area.

Although his broadcast is always upbeat, Darue and his family are terrified. His son constantly asks if they have to evacuate, and they place yellow dots on anything they want to save in an evacuation. Although the danger is slow-moving, conditions have gotten worse. "It's like apocalypse creep, the end of the world that we know oozing up around us, one hot day at a time." For others, the threat is more imminent. In the California city of Pacifica, people face the loss of their houses. In the podcast, resident Jane Tollini describes her disturbing reality -- in 1998, her backyard slid into the ocean, causing her bedroom to hang precariously over the cliff.

The podcast emphasizes the main issue of sea-level rise in Pacifica -- for most people, "theory rarely translated into practice, so it [the danger] didn't seem real." Just two weeks before Jane lost her backyard, she and her neighbors had thrown a party, at which the hypothetical threat of the nearby storms was mocked. This appears to be true for most Pacifica residents, who seem unbothered by the occasional disappearance of a house or apartment. However, in 2018, the California Coastal Commission issued a document with suggested strategies to keep communities safe from sea-level rise.

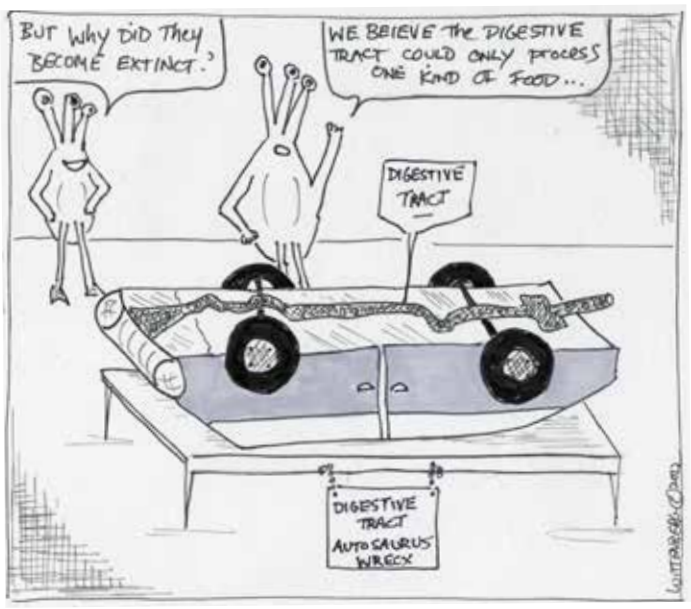
One of these actions is something called "managed retreat," which would mean relocation and construction restrictions in certain areas. Although the mayor of Pacifica, John Keener, sees no issue with the consideration, residents are horrified. In public meetings, participants express their concerns that "it's all going to be taken away from me by something that may or may not happen in the future." A real estate agency distributes documents telling people that their land would be taken with zero compensation. Resident Jeff Guillet first hears about managed retreat through the "inflammatory" brochure, which seemed to deliberately exclude some key information. For instance, instead of the government immediately seizing properties, as the document suggests, "it's a very slow-moving and voluntary process that unfolds over decades."

In this way, the Pacifica situation reflects the overall issue of climate change. Paying now for something that will happen in the future is typically negatively received. "The present owns our heart. The future, if it exists for us at all, lives only in our head." In other words, people want action that helps them now, not in the future. Although understandable, this means that action will always be a late response. Residents such as Guillet, who campaigns against managed retreat, did so because they feared losing their properties. Guillet was terrified that he would lose everything due to managed retreat and worked tirelessly to persuade others to oppose the idea. Eventually, the opposition (led by local real estate associations) reverts to a smear campaign against Mayor Keener, which included nasty photoshopped images of the mayor.

The residents' reaction is understandable. However, they assume that if they defeat managed retreat, they won't lose their homes. This is far from reality. The Coastal Commission was clearly not taking managed retreat lightly and was considering it along with many other possibilities. They realize that without well-thought-out action, residents would eventually lose their homes to the sea rather than the government. Eventually, however, Mayor John Keener loses re-election to an anti-managed retreat candidate. Managed retreat is officially off the table for Pacifica.

While writing this article, I was tempted to include far more quotes than I did. There are countless important and thought-provoking comments in this podcast. Together, they form an incredibly powerful narrative that tells a story that reflects others all over the world. At the end of the podcast, climate reporter Mario Alejandro Ariza discusses the misconception that our resilience will save us, saying that, "the water is going to keep on rising, no matter how resilient we are." We are all resilient. But, in the end, an apocalypse is coming, and we all need to learn from podcasts like these, so we can stop this "surreal horror movie in extremely slow motion."

Victoria Ines is a senior at Shenendehowa High School in Clifton Park, NY. She is passionate about working to protect both the environment and endangered species. After high school, she will be attending college to study environmental engineering. ♻



Cartoon courtesy of Leah Wittenberg. See more of her work at leahwittenberg.com.

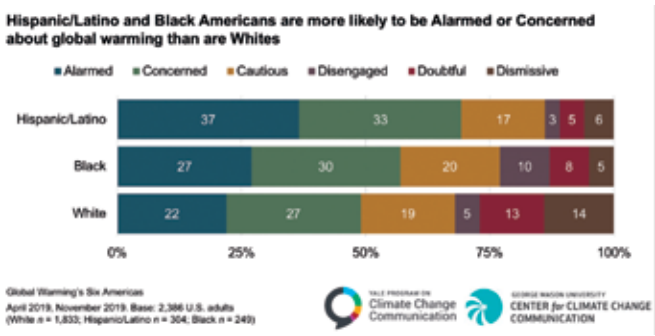
What's Missing?

Cont'd from p.14

'environmentalist'. And this misconception is often perpetuated by the very folks who are most concerned about climate change! The voices of conservatives and BIPOC (black, indigenous, and people of color) communities are often not heard because too often we've made the assumption they're not interested or not on "our side." To dismiss potential allies before determining their actual opinions is not a winning strategy.

CCL recognizes that without welcoming everyone to the table and building respectful relationships – no matter where the other person is on the political spectrum – we will never succeed in passing strong, durable climate legislation https://www.youtube.com/watch?v=7NpzP2HcRPI.

It's not just our politics where we get it wrong. https://on.natgeo.com/3xjPomlWe make other assumptions that get in the way of addressing climate change. In a recent National Geographic article https://on.natgeo.com/3xjPoml), the author notes that many of us are pinning our hopes on carbon sequestration as a means of reducing carbon in the atmosphere. Whether it is individuals offsetting their personal air travel, or large corporations looking to zero out their carbon footprint, we don't always look outside our comfort zone. Craig Welch asks some basic questions: What happens when the forests we are counting on to sequester carbon burn down, releasing their carbon instead of securing it? And what happens when insect infestations – whether native or invasive, whether accelerated by climate change or not – destroy a particular species that plays a big part of an offset program? Here is an excerpt from the article that should bring many of us up short.



"[CarbonPlan] estimated that in the first 10 years of the program, fire loss on offsets was already 5.7 to 6.8 million metric tons. That represents 95% or more of all the fire-related contributions to the buffer pool.

"That means we messed up our calculations so badly that in less than 10 years we've blown through 100 years of credits," said Danny Cullenward, policy director for CarbonPlan.

"His team took a different approach when assessing disease risk. Phytophthora ramorum, the invasive pathogen that causes sudden oak death, already has killed more than 40 million trees in California and Oregon. It disproportionately kills tanoak, a tree native to the coast. CarbonPlan found that 20 offset projects hold roughly 14 million tons of CO2 in tanoak—and that anywhere from 4.7 to 9 million tons of that could be lost to Phytophthora in this century. That would be 82 to 159% of the buffer pool earmarked to cover all forest diseases and insect outbreaks, lost to a single pathogen and a single tree species."

The idea of using carbon offsets via sequestration in tree planting and forest preservation is a wonderful idea, but it is not a reliable method of reducing atmospheric carbon. What will work? Cutting our use of fossil fuels. What is the surest way to cut our use of fossil fuels? Put a price on them.

A carbon tax on the fossil fuel industry in which all revenue generated is returned to consumers, will get to the source of our emissions problem without harming low- and middle-income families. Economists of all political persuasions tell us that putting a price on carbon is the fastest way to drop CO2 levels. A well-designed price on carbon, with a monthly cashback check going to each household, will dramatically reduce carbon emissions, and will protect the economically disadvantaged.

We can't win this fight with most people sitting on the sidelines. We need everyone looking to cut their emissions: conservatives, progressives, rich, poor, BIPOC, white. Further, we need a systemic approach to the problem, not one that is vulnerable to the very problem it seeks to address.

A Band-Aid won't do when a stitch is called for https://energyinnovationact.org.

Bob and Suzannah Ciernia are co-leaders of the Vermont Citizens' Climate Lobby At-Large Chapter. ♻

Geothermal's Moment Has Come

Converting to net-zero, all-electric living may take decades, unless we re-examine low-input energy sources such as ground source heat pumps.

Matt Power

All-electric" living won't happen overnight in the United States.The electric grid, locally and regionally, may not be ready for such a huge new electrical load. Even with the addition of solar panels to generate electricity, a home using air-source heat pumps as its heating and cooling system, with a couple of electric cars in the garage, puts great strain on the nearest transformer.

But we all may have overlooked one ready-to-go solution: geothermal (ground source) heating and cooling loops. A geothermal system achieves much of its BTU output with the operation of small, energy-efficient pumps and a compressor. Modern air source heat pumps, with which almost every home builder is familiar, "extract" heat from ambient air to cool or heat an indoor living space. But compared to ground source heat pumps, they're still energy-intensive.

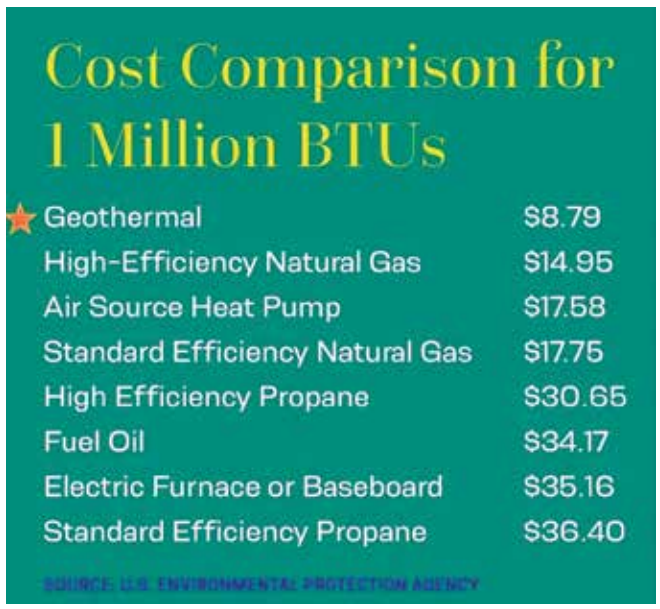
Geothermal heat pumps require less of an electrical assist to achieve the same level of conditioning as air source heat pumps, gas, or oil-based furnaces. One key, according to international researchers, is that most other heating sources rely on high-temperature differences between inputs and outputs. Geothermal, on the other hand, takes a slow and steady approach, tapping into the natural, fairly consistent ground temperature of the Earth, or in some cases, a river or lake.

Heat From the Ground: The Big Picture

Over the last 20 years, the biggest changes in geothermal heating and cooling technology can be seen at larger scales.

"Surprisingly, even in cold northern climates, most of the HVAC system demand in commercial buildings is for cooling," notes Paul Selking, vice president of commercial sales and marketing for WaterFurnace. He explains that because of all the appliances and other heat-producing equipment in these buildings, geothermal loops end up carrying away heat more often than introducing it. But inside that "waste" heat is energy treasure.

"It's all about this heat recovery idea," he explains, "With the advent of variable speed compression and variable speed pumping, this means I don't need to pull more energy out of anywhere; I just need to share the heat where it's needed in my space...even more so in bigger projects, commercial and multifamily.



"Ideally, you're pulling off the cooling loop of your geothermal, and having that loop feed the domestic hot water heater, which has a sealed loop in it. The only wasted energy out of that whole thing is a little compressor heat, but that's pretty minimal."

Enhanced Geothermal Systems for the Home

On the residential side, cost of installation has been the tripping point for geothermal system. But those costs have shrunk somewhat, thanks to compact drills. Some new rigs are no bigger than a Bobcat attachment.

Along with the technology's cost-effective operating cost, geothermal systems boast a long lifespan. This should be part of any return-on-investment (ROI) calculation.

"Even though the installation price of a geothermal system can be several times that of an air-source system of the same heating and cooling capacity, the additional costs may be returned in energy savings in five to 10 years, depending on the cost of energy and available incentives in your area," notes Energy.gov. "System life is estimated at up to 24 years for the inside components and 50-plus years for the ground loop."

By comparison, most estimates I found suggest that the best air source heat pumps last 15 years or less.

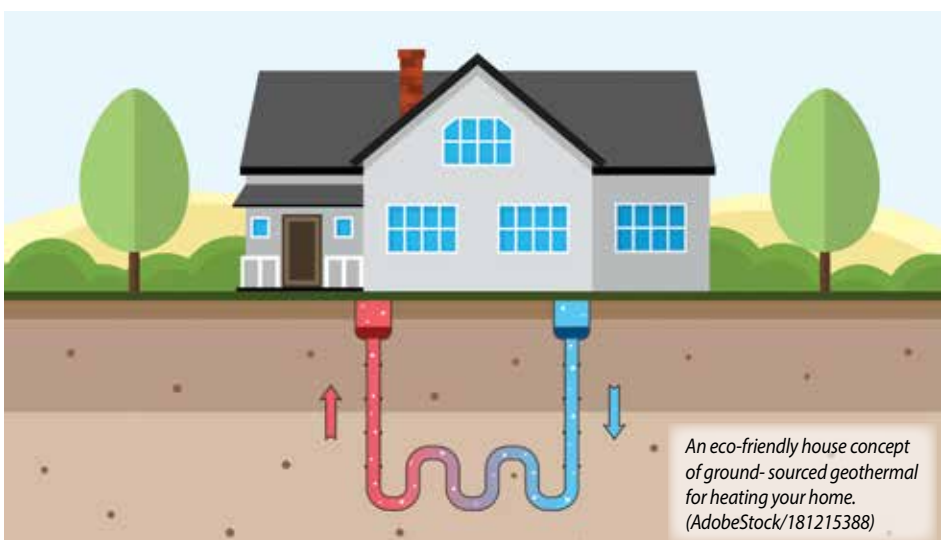
It's shocking to note that only about 50,000 ground-source heat pumps have been installed to date. But I'm confident that as more people seek to achieve a net-zero lifestyle with solar, operating a ground-source heat pump will seem like a prudent and resilient choice. The pain of higher upfront installation costs will quickly dissipate as the house achieves a net-zero-plus energy footprint.

It's not just that. With geothermal HVAC, a home can go fully off-grid with less battery storage. A couple of mini splits can quickly tap out a large solar array. With the same array and a geothermal system, the homeowners will have enough free, renewable electricity left over to power their smart, efficient, electric home.

Matt Power is Editor-in-Chief of Green Builder magazine and greenbuildermedia.com.

Reprinted with permission from Green Builder magazine's April 21, 2022 blog at https://bit.ly/GreenBuilder_GeothermalMomentHasCome. ♻

Pond loop systems are also excellent souces for geothermal. Photo shows a twelve-ton pond loop heat exchanger system being sunk to the bottom of a pond for use in a heat pump installation. (Mark Johnson/Wikipedia.org)



An eco-friendly house concept of ground- sourced geothermal for heating your home. (AdobeStock/181215388)

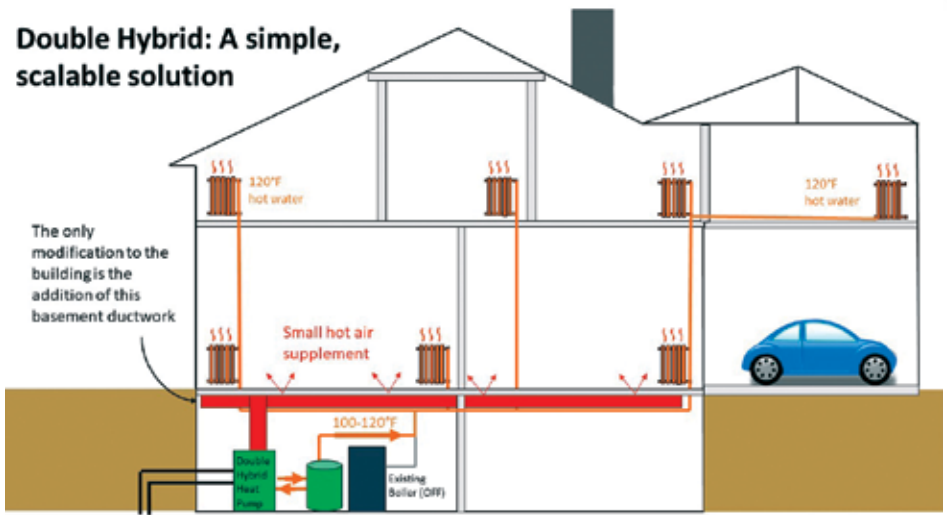
Groundbreaking Technology Provides a Lower Cost Option for Geothermal Heating

G.E.T. *Staff*

For a long time, retrofitting homes with existing hot water boilers has been expensive and time- consuming. But that is changing thanks to an Albany-based startup, Energy Catalyst, which has invented a new hybrid heat pump technology. This new design supplies hot water and air to the building simultaneously, increasing efficiency by 30% while filling the heating gap created by using relatively low temperature hot water in baseboards or radiators.

This may sound like a small accomplishment, but there are millions of homes in the northeast that heat with hot water, and this is the first heat pump that allows them to reuse all of their existing infrastructure and only requires a small amount of ductwork to be added in the basement. "All of these homes have to be converted to clean heat eventually, and this product can do it with 40% lower upfront cost and 30% higher efficiency than ever before," said founder Matt Desmarais. "Homeowners don't want to switch to forced air, they like their baseboards and radiators. So, we designed a heat pump that works with the home that they already have. The additional ductwork is from the basement to the first floor only and provides supplemental heating that doesn't feel drafty and super high efficiency cooling in the summer."

Energy Catalyst's five demonstration projects were covered in the December 2021 issue of Green Energy Times, and the early results are in. The season's efficiency over the course of the winter averaged between 3.8-4.1 COP (coefficient of performance), a large improvement from the Energy Star standard of 3.1. The energy efficient ration (EER) from the early cooling data is about 42 on average, which is a little less than four times more efficient than an Energy Star rated window AC unit.



A diagram of a home with a double hybrid heat pump. The heat pump heats a hot water storage tank and supplies hot water to the building through the same pipes that the boiler once used. New ductwork (in red) is added for supplemental heat and air conditioning. (Source: Energy Catalyst)

One of the most surprising things was how well the unit could heat the building with lower temperature hot water. "On a mild winter day, say around 30ºF outside, the unit may be sending only 100 to 110 ºF water to the baseboards, but the home is still perfectly comfortable and heated to the low 70s ºF thanks to the forced air supplement. It makes sense if you think about it, the forced air reduces the total amount of heat that needs to be produced by the baseboard, and so the remaining BTUs can be delivered with lower temperature hot water. Several homeowners said that the home was more comfortable after the retrofit than with their oil-fired boiler," Desmarais said.

One of Energy Catalyst's demonstration projects was a NY-GEO Top Job Finalist, but the winner of this national contestant went to a project in Wisconsin. During the presentation, Desmarais introduced the company by saying "Our name represents our vision: to be the catalyst for clean energy --hence the name Energy Catalyst."

The startup recently opened their second location in Watervliet, NY (near the Tri Cities) and is doing all they can to keep up with the surge in orders. This is certainly a company to keep an eye on as they grow throughout New England.

For more information on Energy Catalyst and their innovative new heat pumps, visit their website at www.EnergyCatalyst.org. ♻

GEOTHERMAL INCENTIVES UPDATE

This year is looking like the best time in a decade to switch to geothermal heating. In all states, residences can still get a 26% federal tax credit, and in NY there is an extra state tax credit worth up to $5,000. In addition to the tax incentives, three Northeast states have increased their rebates in recent years. The rebates in NY vary from $1,500 to $5,000 per 10,000 BTU/h, and the highest incentives are in Con Edison's territory. In Vermont, the rebates are $2,100 per 12,000 BTU/h of cooling capacity and can be accessed by working with a participating contractor. Massachusetts offers some of the best rebates with $15,000 per residential home, regardless of the size of the geothermal heat pump. This could be especially valuable for high efficiency homes that use smaller heat pumps. See pages 16 and 17 of this issue for incentives for other regions.

The fastest growing reason to switch to clean geothermal may be a practical one: heating a home with geothermal this winter will cost a quarter as much as fuel oil or propane. With promising new technologies like the hybrid heat pump entering the market, there has never been a better time to switch to high efficiency geothermal heating and cooling. ♻

TAMING SUMMER'S UTILITY BILL

Cont'd from p. 1

The post-pandemic "hybrid home" trend has led to a surge in energy demand with working from home becoming increasingly common. (Fujitsu General America)

workers believing a hybrid model would be optimal going forward, according to an Accenture survey, and 87% of managers believing working from home is the future, according to Remote-How research.

All that being said, families and households can help offset this "utility bill trifecta" so to speak, and decrease their household carbon emissions by following a few simple tips. With home heating and cooling accounting for more than half of home energy use, small steps can go a long way.

Think Conservation and Efficiency: These two, equally important, concepts are similar but involve different methods. Energy conservation is the practice of using less energy in order to lower costs and reduce environmental impact. Energy efficiency means using specific products designed to use less energy. Both are essential elements for an eco-conscious household.

Ease Into Electric: According to Columbia University's Earth Institute, electric systems are a solution to decarbonize home climate control. Among the most energy-efficient heating and cooling products, electricity-powered ductless mini-split systems, offered by companies including Fujitsu General America, can save as much as 25% on your energy bill for both heating and cooling. Mini-splits use an advanced refrigerant system to distribute tempered refrigerant to an indoor air-handler, where the air is quietly distributed to the interior space.

Get "Smart" About Climate Control: When it comes to smart home temperature control, there are Smart HVAC Systems and Smart Thermostats. Smart HVAC systems have built-in internet capability and can be controlled directly without additional equipment. Smart Home thermostats create "smart" systems by enabling remote temperature control via a mobile or internet-connected device or voice-operated home automation system.

Voice Your Preference: Take control of your comfort. Most HVAC manufacturers offer apps that enable systems to be controlled from anywhere using a mobile device. Voice-control capability uses digital assistants, like Amazon Alexa or Google Home, to verbally dictate home temperatures. Easily controlling the temperature more closely, allows homeowners to be more comfortable and improve energy savings.

Find Your Efficient Comfort Zone: Many of us live in homes designed for bigger households, but have yet to downsize. If you find yourself using a fraction of your home on a regular basis, consider making some modifications for using less space. For instance, upgrading to a zoned ducted or ductless system will allow you to save energy heating and cooling spaces where you and your family don't spend a lot of time. This will multiply savings as you're not only needing less heating or cooling but you also gain from a more efficient system in the spaces you do still use.

Turn it Up: For air conditioning, even a slight temperature increase can make a difference. You can save as much as 10% a year on heating and cooling by simply adjusting your thermostat a mere seven to ten degrees for eight hours a day from its normal setting. For example, keep your house warmer than normal when you are away, and set it as high as is comfortable when you are home.

Work Your Windows: About 76% of sunlight that falls on standard double-pane windows enters to become heat, according to the U.S. Department of energy. Close all windows and coverings to keep your house cool. For natural light, open those window coverings that don't get direct sunlight. Cellular shades can reduce unwanted solar heat through windows by up to 60%. When selecting new windows, consider factors including the frame materials, the glazing or glass features, gas fills and spacers, and the type of operation.

Small everyday changes can also have a big impact. Use heat-producing appliances – stoves, irons and dryers – at night or early morning. A ceiling fan will allow you to raise the thermostat setting about 4°F with no reduction in comfort. Seal air leaks around windows, doors, and places where pipes and wires come through walls. Check existing caulking and weather-stripping for gaps or cracks.

Global change is made one household at a time. This season, eco-conscious homeowners can take meaningful action to make curbing their energy bill and carbon footprint more than just a summer dream.

Dennis Stinson is the Vice President of Sales for Fujitsu General America. ♻

Forest Carbon

Cont'd from p.1

plant, factory, building heating unit or car or truck on the road.

There are two important terms to understand if we want to talk about forest carbon and climate change:

- **Carbon sequestration** – the process of removing carbon from the atmosphere through photosynthesis and storing it in another form that cannot immediately be released - wood.
- **Carbon storage** – the total amount of carbon contained in a forest both aboveground (mostly trees) and below ground (mostly soil) at a given time.

Carbon sequestration is about today and the future. What we want from our forests is to offset as much of atmospheric emissions today and into the future – across the landscape. Scale – i.e. landscape - discussion is extremely important because climate change and greenhouse gas emissions are not just about one spot on earth, instead, it is a global issue. The kind of forest across the landscape that sequesters the most carbon is a young to middle aged forest – NOT an old forest.

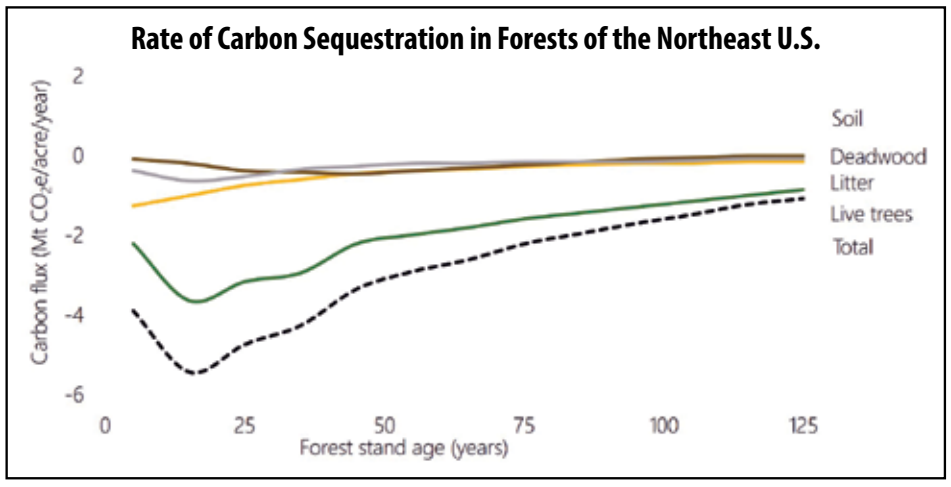


Figure 1: Important note: negative numbers mean more carbon sequestration. (Keeton et al 2011).

Rate of Carbon Sequestration in Forests of the Northeast U.S.

Figure 1 shows that forests less than 20 years old sequester the most carbon. Larger negative numbers in the graph show the highest sequestration rates. As the forest ages, the rate of sequestration over the landscape is reduced. So, if we want high carbon sequestration rates today and in the future to offset greenhouse gas emissions causing climate change – we want younger forests.

Carbon storage is the opposite of sequestration when it comes to forest age. As forests grow older and the trees become larger, they store more carbon than younger forests. This carbon storage represents the sequestration that occurred in the past – which we cannot change. We don't want to release all the forest carbon in these older (or even younger forests), but carbon storage does not address today's, and future, emissions. Younger, vigorously growing forests are the best across the landscape at removing the most greenhouse gas emissions (carbon) to combat emissions from fossil fuel burning and their effects resulting in climate change.

What about cutting trees? We use wood from trees for so many things in our lives: from our homes, to furniture, to heat our homes and yes, for toilet paper and paper in books. Products from trees are so much more environmentally friendly than from fossil fuel sourced products (think steel and concrete in buildings or plastics) because trees and forests are renewable. In the northeast U.S. they grow back naturally – we don't have to plant them – because our soils, climate and tree species naturally produce seed or sprouting from stumps to regrow our forests.

Simple thinking says if we don't cut trees then the planet will be better off because trees sequester carbon. The problem with that thinking is the issue of "leakage" and myth #2. Leakage from a forest carbon perspective is that if you don't harvest a tree here for products, it will be harvested somewhere else because demand for wood products is increasing in our region, the country and the world (See figure 2).

It is naïve to think that if we stop harvesting a tree on a property or in our region that there are only positive climate effects. In the northeast U.S., we have laws and regulations to assure that timber harvesting is done in an environmentally sound manner. If we don't harvest trees here, they will be harvested elsewhere – and maybe in parts of the world with less resilient forests like the rainforests of South America. This would not be better for the planet.

Harvesting trees sustainably here also can increase growth rates on the remaining trees in the forest where harvesting occurred, resulting in increased carbon sequestration rates – the most important part of forest carbon and climate change.

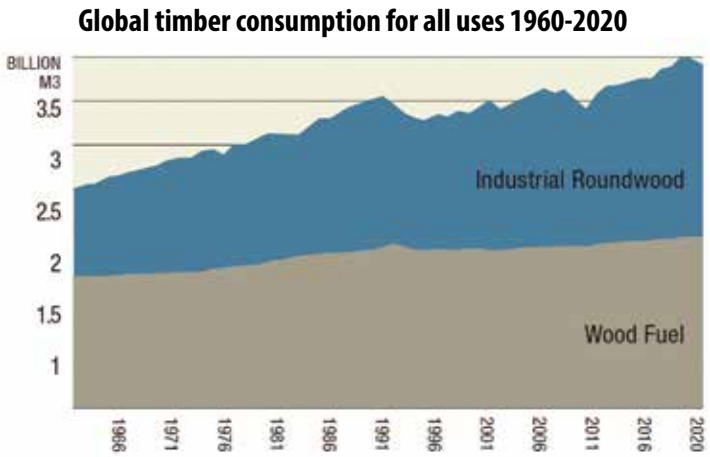


Figure 2: Global Timber Consumption for all Uses 1960-2020 (United Nations Food and Agriculture Organization 2020)

Global timber consumption for all uses 1960-2020. [See figure 2: from the United Nations Food and Agriculture Organization 2020].

And by the way, we grow way more trees and carbon in our northeastern forests than we remove each year. We will talk much more about that in the next article.

So, the bottom line is that younger forests sequester more forest carbon per area than older forests and cutting trees here in the northeast, for all the valuable products we need, can be done sustainably in a forest that grows way more than is harvested each year. Not harvesting here just pushes the demand for forest products to other forest harvesting elsewhere and does not result in an improvement in our global climate change situation.

Charles Levesque is President of Innovative Natural Resource Solutions, LLC – a northeastern U.S. based consulting firm. He also serves as Executive Director of the North East State Foresters Association and is Coordinator of the new Securing Northeast Forest Carbon Program. ♻

Securing Northeast Forest Carbon Program *is an effort by the state governments in the seven-state New England and New York region to educate about forest carbon and the role trees and forests play in combatting climate change. A clearinghouse of information on forest carbon is at the Program website at www.northeastforestcarbon.org.* ♻

Quechee Gorge, Vermont (Matthew Bellemare/ CC-BY-SA 3.0)

Net-Zero Home Emerges from Sustainable Lifestyle

Dan Vastyan

For decades, Janet Armstrong and Lloyd Davies lived and breathed the sustainable lifestyle. Their way of life ties to the example set by Janet's father, who built the first solar house in Vancouver, BC, in 1978.

Armstrong and Davies lived in their first home in Vernon for 35 years, making many energy-conscious improvements as time passed. After retiring, they wanted a home that required less maintenance and offered an even smaller carbon footprint.

The 2,600 square-foot home boasts a blower-door test rating of 0.59 air changes per hour (ACH), compared to a similar home built to minimum local standards which would typically have an ACH of about 3.5. (Courtesy images)

The couple wanted the 2,600 square-foot home to blend in with others in the neighborhood while being supremely energy efficient and sustainable. The craftsman- style residence includes an in-law suite, greenhouse and wrap-around deck.

Rainwater from the standing-seam roof is used to water vegetable gardens, and a 35-panel, 10.85 kW solar array provided 103% of the home's total energy needs last year, making it a net-zero residence. The solar PV is just the beginning of its eco-friendly amenities.

Tight construction

Stonebridge Net Zero Construction Ltd. built their dream which included the Japanese aesthetic of making every square inch of a house count.

The home was to be extremely comfortable, functional and efficient, while also providing performance feedback through its control system.

Hardie Plank fiber cement siding is used on the home's exterior, along with a standing seam metal roof. Exterior walls are double thickness with a half-inch gap between inner and outer studs to minimize thermal bridging. Blown-in cellulose insulation fills the stud bays and all wall penetrations were sealed for an airtight shell. On the outside of the plywood sheathing, Roxsul Comfort Board insulation was applied, bringing the exterior walls to roughly R-38.

More than six inches of Styrofoam insulation paired with a double vapor barrier are used under the home. Two-inch dense foam was used on the inside of the footings to isolate the slab. In the attic, an R-60 layer of cellulose insulation was blown in. All exterior doors and windows are triple-pane, supplied by Innotech Windows + Doors, Inc., a manufacturer in British Columbia.

The ultra-tight construction provides a blower-door test rating of 0.59 air changes per hour (ACH). A similar home built to minimum local standards would typically have a rating of about 3.5 ACH.

Because a home needs fresh air infiltration to maintain a healthy living environment, the house has a fresh air system that includes a heat recovery ventilator (HRV) tied to a series of four "earth tubes." These 10-inch diameter, high density polyethylene tubes are buried between seven and nine feet deep along the foundation of the home. The soil temperature in the area remains at roughly 50°F (10°C), conditioning fresh air in the winter. It also provides the only source of AC in the summer. This system, along with the home's graywater recycling system, was designed by Trevor Butler, P.Eng., at Archineers Consulting Ltd. in Kelowna.

In the winter, the HRV further warms incoming fresh air by transferring heat from the outgoing air. This fresh air system runs continuously. Discharge air from the HRV is blown over the outdoor portion of the heat pump, providing yet another source of waste heat utilization.

"An energy study revealed that the home is one of the most energy efficient residences in Canada," said Davies.

Total control

A 34,000 BTU Maritime Geothermal air-to-water heat pump supplies hot water to 10 zones of in-floor radiant heat. The basement slab includes hydronic tubing. The home's wooden structure is rated to carry a three-inch slab of concrete on the second and third floors. There, hydronic tubing was fastened on top of the subfloor with concrete poured over.

Everything in the home is controlled by an extensive tekmar control system. Thermostats control the radiant floor heating temperature and air cooling temperatures. A House Control operates the air-to-water heat pump and regulates the supply water temperature based upon outdoor reset.

Providing power to the thermostats and hydronic zone valves is a Wiring Center, and a tekmar Net Gateway provides internet connectivity through a mobile app and website.

Additionally, 35 tekmar sensors are used to measure and monitor building performance. These sensors, which are connected to a data acquisition system, are scattered throughout the home; in the floor, in the walls, outside, etc., providing real time feedback.

Top: The earth tubes terminate in a small, open-air structure in the backyard; bottom: The indoor termination of the earth tubes, providing the only source of air conditioning.

Uniquely British Columbian

A cold room is used to store fresh fruits, vegetables and wine. It's brilliantly cooled by 39°F (4°C) discharge air from the home's Rheem hybrid heat pump water heater. The room remains at 37°F (3°C) in the winter and 50°F (10°C) during the summer. A hot room with a large window on the second floor provides passive solar energy on sunny days no matter the season, and warms a small greenhouse. Warm air generated in this room is circulated within the house by the HRV. There is also a passive solar hot water panel inside the hot room that provides preheated water to the water heater.

The home features the first locally-approved gray water diversion system, often called "purple pipe," which reduces the sewage flow by 60% during spring, summer and fall, when the landscape irrigation system runs.

"Lots of hard work and sweat has built a wonderful home," said Davies. "It's warm where it needs to be, cool where it should be and very quiet because of the great windows, doors and insulation. Our costs to live here are very modest. We have no gas or electric bills. Our only expenses are city utilities, house insurance and city taxes. We love it."

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

Why Is It Easier to Build a Dollar Store Than To Install Solar Panels in the State of Vermont?

Op-ed by Peter Sterling

Family Dollar store in Bradford, Vermont. (Staff image)

Over the last decade or so while most of us weren't looking, something very disturbing has happened in Vermont: it has become easier to build commercial strip development like a Dollar General store in a rural town than to build renewable energy.

Between 2006-2020, 37 Family Dollar or Dollar General stores opened in Vermont. By comparison, Vermont hasn't allowed a utility-scale wind array to be built since 2012, and none are being planned for the foreseeable future. I'm not picking on Dollar General, they aren't breaking any laws and in many communities are the go-to place to shop for many residents. But something is very wrong when it's harder to build the renewable energy we need to stave off climate chaos, than it is to build another chain store.

Why is this? In general, unless they trigger Act 250, Vermont's development-control law since 1975, most commercial projects only have to comply with local zoning ordinances. Meanwhile, commercial renewable energy projects have to run a regulatory gauntlet that gets more restrictive and less predictable every year.

By law, Vermont's Public Utilities Commission (PUC) treats each application for commercial wind and solar as a "contested case" litigation requiring more extensive evidence for approval than any other local or state agency permitting. Most wind and solar projects must meet all the same criteria as applied to other development under Act 250 plus comply with additional PUC rules, special criteria set by the legislature, comply with town and regional plans and obtain permits from the Vermont Agency of Natural Resources before being considered for approval by the PUC. Going through all of this excessive permitting adds a lot of cost to these renewable energy projects and often results in otherwise well-planned projects being rejected. In the end, all of this red tape greatly disincentivizes Vermont from going solar.

In one example, a landowner in Bradford was trying to install solar panels on a parcel near a highway interchange that was behind a Hannaford's shopping plaza and next to an existing auto parts supply warehouse, self-storage facility, convenience store and gas station. The PUC denied the permit for the solar array based on its aesthetic impacts to this industrial area. It is hard to comprehend how the PUC believes solar panels conflict with the aesthetic nature of an industrial area.

The PUC has also crafted the most restrictive statewide sound standard for wind power in the nation making the siting of wind energy projects basically impossible. Vermont now has a standard for sound from a wind turbine (39 decibels allowed at night) which is quieter than even the 40 decibels of background noise generally allowed in a library! And since no one is planning on damming any more of Vermont's rivers for hydro power, the only way for us to create more renewable energy in the short term is more solar.

Vermont uses about 2,000 gigawatts of electricity annually while building about 40 MW of new solar each year- roughly 2.5% of our total power need. This is nowhere near enough for Vermont to be playing its part in combating climate change. And the need for renewables is sure to grow as state policies continue to encourage us to kick our fossil fuel addiction and electrify our transportation and home heating and cooling. Experts I have talked to in the solar energy field say we should be deploying at least 80MW of renewables each year and could if only state regulators would treat the renewable energy industry like they do other businesses- with a fair and predictable permitting process that allows for properly conceived and sited projects that are supported in a town's plan to move forward.

Summing up the problem (and solution), Bill McKibben, a Vermonter leading the global effort to combat climate change, said it best in his outstanding piece, "A Thing So 'Shocking and Offensive' It Literally Can't Be Permitted", the title of which refers to a sentence in a PUC decision rejecting a solar array visible to just ten homes again based on aesthetics. "When we look at a solar panel or a wind turbine, we need to be able to see—and our leaders need to help us see, because that's what leadership involves--that there's something beautiful reflected back out of that silicon: people finally taking responsibility for the impact our lives have on the world and the people around us."

Peter Sterling is the Executive Director for Renewable Energy Vermont. ♻

Zero Accessory Dwelling Units: Low-Income Housing that Works

Joe Emerson

We all know there is a considerable lack of affordable housing in the U.S. and that addressing it effectively has been challenging. Now that many states and municipalities are altering their zoning to allow accessory dwelling units (ADUs), there is a new opportunity to expand truly affordable rental housing, by building low-cost zero energy ADUs. These are sometimes referred to as in-law apartments, garage apartments, attic apartments, tiny homes, or casitas. But how to make them truly affordable?

A Zero Accessory Dwelling Unit in Bend, Oregon provides affordable small, well-designed living spaces with no energy bills. (Joe Emerson)

Small ADUs are Affordable

By their very nature, ADUs will cost less to rent because they are smaller, and building them uses fewer materials. This is even more likely in an above the garage, basement, or attic ADU where existing structural elements can be used. They also have no land costs because they are built on an existing lot or above an existing garage. And there are no landscaping costs other than restoring any construction disruption. Sewer, water, and electricity are close at hand. And, if they are zero energy ADUs, they will need no gas hook-up. More important, they will have no, or almost no, energy bills for their residents.

Zero Energy Bills

There are two legs to affordability. One is the rent – the other is the monthly utility bill. The second one is almost always overlooked when considering affordable housing, but high energy bills can play a devastating role in making an ADU rental unaffordable. Zero Energy ADUs solve that problem and offer a more truly affordable rental. The challenge is how to get to zero at least cost, so the rent can be kept low.

Cost Cutting Zero ADU Construction

The first step in low-cost zero energy construction is conducting energy modeling on the planned structure. Energy modeling will help select the lowest cost mix of energy-saving measures such as insulation and air sealing, energy-saving equipment, and solar. For example, energy modeling and price comparisons will quickly determine whether it is more cost-effective to use a heat pump water heater or add some additional panels and use a standard water heater – or whether to use insulation with a higher or lower u-value.

There are other potential savings related to the smaller size of an ADU. Windows are expensive. Locating them to optimize light and views, and eliminating or reducing them where they are not needed, may allow smaller glazed areas. Since mini splits can be ductless, there is no need for ductwork. Most ADUs can be heated and cooled with one small unit, which is quick and easy to install. Since heat pump HVAC systems should never be oversized, smaller ones are usually the best choice.

In small homes, such as ADUs, energy or heat recovery ventilation systems can be installed without ducts, using a Lunos e2 through-the-wall HRV or a Panasonic Whisper Quiet ERV to provide fresh filtered air. The size of the water heating system can be tailored to a smaller household. A smaller 30 or 50-gallon heat-pump water heater is an excellent but more expensive option. Using a small well insulated standard electric water heater with added solar panels may be less costly. An even more economical option might be using one or two-point of use tankless electric water heaters – one in the bath and one in the kitchen – and adding sufficient solar to cover its energy use.

An ADU Solar Advantage

Another significant potential savings with constructing a stand-alone ADU is a second chance to install solar on the main property. If the original home does not have a good solar orientation, it may be possible to orient and design an ADU with enough solar for both the original home and the ADU. Any ADU-related shed or garage can be designed to optimize solar exposure. Large roof overhangs to shade the southern or western sun to avoid overheating can also expand the solar area. Or depending on orientation, sufficient solar can be installed on the main home to supply both the main house and the ADU – or some panels can be installed on the sunniest areas of each roof. In any case, optimizing the number of solar panels will lower the cost of ownership and renting.

Small ADUs can Live Large

The key to a successful small ADU is designing it for large living. Building inexpensive non-conditioned storage spaces outside of the conditioned ADU, either in an attached or stand-alone shed or added to a

Cont'd on p.37

Efficiency Vermont's Efficiency Excellence Network (EEN)

Contractor Spotlight: A Look Inside

Learn more at Efficiency Vermont's website: EFFICIENCYVERMONT.COM

Efficiency Vermont's Best of the Best Awards

G.E.T. *Staff*

During April's Better Buildings by Design conference, two businesses were recognized for Efficiency Vermont's Best of the Best (BOB) awards from the Efficiency Excellence Network (EEN). Farnum Insulators was recognized as the EEN Partner of the Year. Maple Leaf Mechanical was recognized with EEN's Leadership Award.

Efficiency Vermont's Bryn Oaklef presents Chad Farnum of Farnum Insulators with the Efficiency Vermont EEN Partner of the Year award. (Courtesy photos)

The EEN Partner of the Year Award recognizes a firm or individual in the Efficiency Excellence Network that has demonstrated unusual commitment as an Efficiency Vermont partner. Farnum Insulators from East Dummerston, VT is a longtime EEN Home Performance with Energy Star (HPwES) partner. They have been with the program for over a decade. In 2020, they were able to rise to the challenge of quickly serving customers through increased incentives with almost no negative customer feedback. In 2021, they continued to meet the growing demand for weatherization in their territory of service.

"Farnum continues to set a high bar with their commitment to energy efficiency, their tireless work to promote available offers and their overall spirit of true partnership," stated Steve Spatz, an account manager with Efficiency Vermont. "We are proud to honor Farnum Insulators with this year's Partner of the Year award."

Farnum Insulators is a key contributor in the collective effort to increase the number of homes weatherized by 2030. Their ability to expand their weatherization business without compromising quality for their customers is something to be celebrated. They have served nearly 600 customers since joining the HPwES program.

Farnum Insulators is a full-service insulation company serving Vermont, New Hampshire and Northern Massachusetts. New England's weather requires buildings to have a higher standard for insulation than many other parts of the country. Farnum Insulators works with homeowners, businesses and institutions to assess buildings insulation needs through thorough diagnostic testing, creates the most cost-effective and non-invasive plan to increase energy efficiency, and finds all available cost saving incentives to reduce your costs. Learn more at www.farnuminsulators.com.

The EEN Leadership Award recognizes a firm or individual in the EEN who has demonstrated innovation, influence, and commitment to the energy efficiency industry. Maple Leaf Mechanical from Fair Haven, VT is this year's award winner.

Partners, Jake Gavin and Matthew Lannon, are always looking to help their customers to access Efficiency Vermont's rebates and offers, whether it is through lighting projects, refrigeration projects, heat pump installations and other energy efficiency work.

"Maple Leaf Mechanical leads by example in their ability to maintain excellent quality of work while keeping energy efficiency a top priority in their refrigeration, HVAC, and electrical work," noted Cooper Thompson, an account manager with Efficiency Vermont. "They have collaborated on many projects with Efficiency Vermont and continue to lead with their creative problem solving and innovative approach to energy efficiency."

In 2021 alone, Maple Leaf Mechanical enrolled in two Efficiency Vermont pilot programs: Integrated Controls and Leak Repair. In addition, they consistently volunteer to handle both challenging customers and projects, all while putting in the time to make sure they are prepared to do a good job.

Maple Leaf Mechanical can be reached at 802-683-5192. ♻

Jake Galvin (left) of Maple Leaf Mechanical receives the Efficiency Vermont EEN Leadership award from Cooper Thompson.

Concrete Decarbonization:

The Cement Industry's Decarbonization Plan Is a Good First Step

Matt Power

Uncoupling concrete use and production from the tangled chain of materials and processes required to make it will require more than good intentions.

As recently as September 2021, several news articles, including one in *Nature*, seemed to take a sudden interest in the intense ecological costs of producing concrete. The biggest ecological villain, of course, is the cement in the mix, which requires extremes of heat (and thus energy) for production. It's also difficult to extract and transport.

So perhaps it's a coincidence that the Portland Cement Association (PCA) recently released a comprehensive plan titled *Roadmap to Carbon Neutrality*, that aims to take cement off the ecological hot seat.

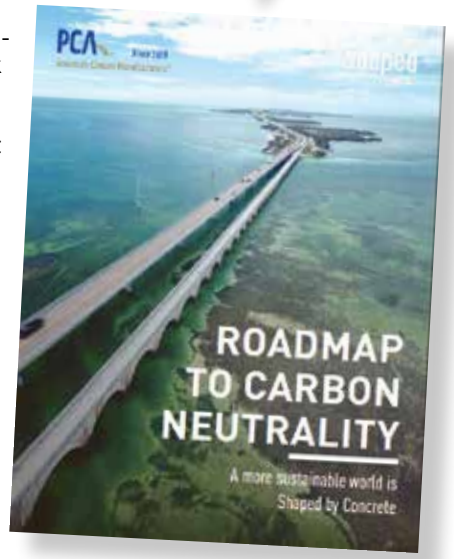
I've seen these types of grand industry plans come and go, often without the follow-through to claim success after the initial enthusiasm fades. That's not to undercut the effort, it's to keep the pressure on, now that an initial plan has been outlined.

So, what's in the plan?

I gave the full document a quick read. One thing that I think it's important to establish is that there is not, nor will there ever be, "carbon neutral" concrete, any more than there will be "carbon neutral" housing.

Any man-made endeavor that requires energy, resource extraction, and transportation produces pollution. All you can do is try to mitigate those initial effects by using less energy, specifying less CO_2 intensive materials, offset them with things like renewable energy production, and, sometime in the (at this point far distant) future, actively sequester the carbon created by the production process.

Not every approach to reducing cement's heavy CO_2 impact is equal, however, and that may be something for PCA to consider. The organization presents the various approaches to reducing the CO_2 impacts of cement as a sort of a la carte menu of options. But some ideas floated in the plan, such as emphasizing concrete's natural tendency to act as a CO_2 sink during its lifespan, probably should not be included in the list of actionable ideas.



Concrete does absorb CO_2, but that's been the case for 1,000 years. All we'd be talking about is whether new types of admixtures could increase the absorption rate, which is a valid area of R&D, but maybe not something to focus on.

That being said, I don't disagree with the "do everything that helps" approach PCA has taken. They've acknowledged that reining in concrete's footprint (with an emphasis on cement) will require changes at every level of the material's life cycle. From extraction of raw materials to the choice of clinkers and mixing agents, to the suitability of concrete mixes for recycling.

The challenges are many, but not insurmountable. We need greener filler and admixtures, for example, but many specifications, especially on the commercial side, only accept certain additives.

Some promising alternatives, however, have an ongoing public relations problem. Low-cost fly ash, for instance, has not become a mainstay of the industry, in part because its chemistry needs to be studied and discussed with more transparency to remove ongoing public concerns about heavy metals and other pollutants that could be left in the post-industrial waste. And as it turns out, there are indeed toxins in fly ash, but it took the discovery that some of those are rare metals to get to the truth. Now Sandia Laboratories wants to get at those metals to build more weapons of mass destruction, so we may finally see fly ash find a clean pathway into cement.

It's also understandable that building experts like to move slowly on changes to concrete formulation. Durability is key. In Ireland, for example, one company's use of excessive amounts of mica in the mix for concrete blocks has led to thousands of building failures.

It's hard to disagree with PCA's assertion that concrete will remain an essential base material for the resilient infrastructure we need to survive climate change. We'll need homes with sturdy foundations that can withstand floods, monster hurricanes, and so on. It's good to see the cement industry taking steps, however, to address their own significant role in global warming.

What Can Builders and Architects Do?

Residential builders have a lot more flexibility when selecting concrete options than their commercial counterparts. In the field here are a few ways to reduce concrete impacts immediately.

1. Go shallow. Frost-protected shallow foundations (click to download a guide from HUD) can reduce concrete use in new homes by about 65 percent. These are now part of the building code. Basements, in my experience, often create more long-term headaches than they're worth. Keep things simple. Instead of a slab-on-grade, consider a crawlspace design to save even more concrete.

2. Inquire about green concrete. Ask your local concrete supplier what alternative mix materials might be available. According to TNT Materials, options may include:

- Fly ash from coal power plants.
- Ground granulated blast slag, or slag cement from steel mills.
- Silica fumes left over in electric furnaces during the production of silicon alloys.
- Fiberglass and waste glass.
- Rice husk ash.
- Burnt clay.
- Sawdust.
- Foundry sand

3. Pave conservatively. Concrete pavement, curbs, and sidewalks often represent a larger footprint than the residential properties they surround. But they come at a high environmental cost. Consider greener alternatives: pavers made from recycled aggregate, locally quarried crushed stone walkways, hardy perennial ground cover, or even natural gravel with good drainage. Homeowners may push back against less "permanent" materials, but chances are that they don't have all the information. Many cities also offer a discounted rate for wastewater runoff for porous walks and driveways.

4. Stay away from 3D printed homes until 3D manufacturers incorporate hemp or other materials in place of limestone cement. I've been barraged with press releases about these machine-made homes recently. But what I've seen in the videos so far are projects with huge CO_2 footprints—walls made of 100 percent concrete, served up in layers. Let me be even more specific: Lennar is doing a big 3D printed home project with ICON, but on ICON's website, I could not find a single mention of sustainability related to these homes. In addition, there seems to be no insight into R-values or HERS ratings or other metrics that might provide a sense of what we are getting for our money with 3D printed housing.

Download the PCA's full plan at https://bit.ly/PCA_RoadmaptoCarbonNeutrality

Matt Power is Editor-in-Chief for Green Builder Media

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Warm and Cool Homes- Part Two: Wallace-Brill Home

Wes Golomb and Bob Irving

Our society's well-being is dependent upon our ability to move from a fossil-fuel economy to an economy based on sustainable energy. A path to this goal can be described as the "three-legged stool" approach.

The first leg of the stool is efficiency. In short this means using the minimal amount of energy needed to accomplish a task. Using light bulbs, for example, you could use an incandescent or compact fluorescent bulb, but the most efficient lighting would be a LED. Each energy- consuming device should be analyzed similarly to determine the most efficient way of accomplishing the desired task.

The second leg of the stool is electrification. This means the conversion of fossil fuel combustion engines or heating units to electricity. In general, such a conversion cuts the amount of energy required for a task by about one-third.

The third leg of the stool is the generation of electricity by sustainable means such as solar, wind, and hydroelectric.

On a macro scale, this three-legged stool approach is the blueprint for our society's path to decarbonization. On a micro scale, it is the exact recipe for building a net-zero home.

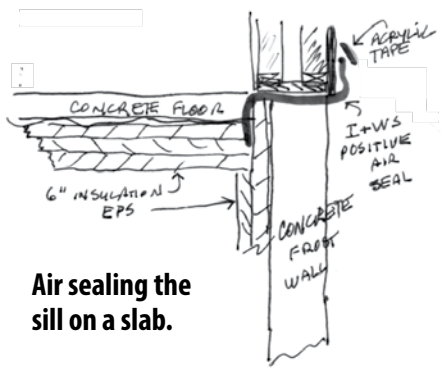
The net-zero home we're going to focus on is a home that RH Irving Homebuilders built in Barrington, NH which uses the three-legged stool strategy described above.

Lessa Brill and John Wallace raised their children in Barrington, NH. They wanted to downsize and remain in the community. An energy-efficient home was high on their priorities list, but, after an exhaustive search, they could not find such a home for sale in their community. This was the motivation to build a home.

In a house, making the envelope as tight as possible is a primary strategy for maximizing efficiency; appropriate types and amounts of insulation and high efficiency appliances are also key components.

The Wallace Brill home is a post and beam construction. It is built on a slab and has no attic or basement. A rubber EDPM gasket was used to air-seal the sill, and six inches of expanded polystyrene (R24) insulates the concrete floor. All seams on the exterior are taped. The house tested at less than one air change per hour, a very respectable number. However, the sill remains a source of some air leakage.

The Wallace-Brill net-zero home is a post and beam construction. (Wes Golomb)



Air sealing the sill on a slab.

Since building this house RH Irving Homebuilders is using a different technique. After the foundation is poured, an ice and water shield is installed onto the inside of the foundation walls. It is then adhered to the top of the foundation and after the walls are built, it is attached to the outside of the wooden wall. This way no air can penetrate the sill.

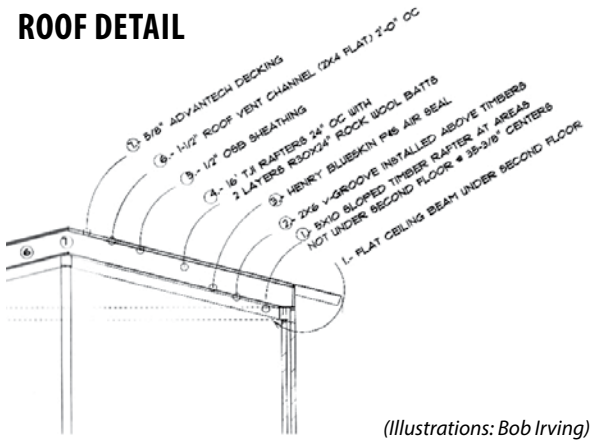
The house has double two-by-four walls with a three-inch gap (ten inches total) filled with cellulose insulation. The double walls minimize thermal bridging. The windows are triple pane.

The construction of the timber framed roof presented an interesting challenge. It needed to be air sealed, super-insulated and thermal bridging minimized without using foam insulation. The challenge was to satisfy all of these requirements and produce a finished ceiling of two-by-six spruce.

The spruce sits on top of the beams, so the builders had to build from the bottom up. A peel-and-stick membrane was applied to the spruce ceiling and serves as part of the ceiling air barrier, above which sit sixteen TJI's (Trus Joist I-Joist, engineered floor joists and rafters made from wood chips). This met all the structural requirements.

The TJI bays were filled with R-60 batts of rock wool insulation thencovered with half-inch oriented strandboard (OSB) sheathing. The roof is strapped with two-by-fours above the TJIs allowing the needed air space to vent any moisture so as to keep it from accumulating. The roof assembly was then covered with half-inch Advantech, a type of high-density sheathing that looks like an OSB but is water-resistant. The Advantech was covered by a roofing membrane fabric and lastly, a low maintenance standing seam metal roof.

ROOF DETAIL



(Illustrations: Bob Irving)

Like all tight houses, the Wallace-Brill home needs heat recovery ventilation (HRV). Instead of using a ducted central system, a Lunos through-the-wall system was used. This system uses pairs of circular vents with ceramic cores which absorb and release heat and are installed in synchronized pairs for balanced ventilation. One unit supplies incoming warmed air, the other exhausts air which loses heat to the ceramic core, and they switch direction at one-minute intervals. There is some noise associated with the Lunos which is noticeable and sometimes annoying.

The home satisfies the first leg of the stool, efficiency, by airtight construction, and high levels of insulation Additionally, it minimizes electrical demand with LED lighting, efficient kitchen appliances such as an induction cook stove, and heat pumps to heat, cool and dehumidify.

The second leg of the stool, electrification, is accomplished by using an induction cook stove, and heat pumps which efficiently heat and cool with no combustion. John and Lessa augment the heat pumps with wood heat.

The third leg of the stool, sustainable power generation, is accomplished with 6kW of rooftop solar installed by 603 Solar. Last year they spent $150.00 on electricity and burned less than two cords of wood.

Wes Golomb, is a long-time clean energy and climate advocate from Deerfield, NH. Bob Irving is the owner of RH Irving Home Builders, specializing in high performance building practices since 1972. ♻

Sheep Keep the Farm in "Solar Farming"

Michael J. Daley

The typical "solar farm' with large swaths of – to some – beautiful glistening blue solar panels may look like a monolithic ground cover when glimpsed from the highway, but in fact there is ample open space between rows and beneath panels to allow plant life to thrive. Anyone living near a neglected farm field in the humid, fecund northeast is familiar with the rapid way Nature reclaims the land. Within a few years scrub growth is abundant and shooting up for the clouds. Without regular maintenance, Nature would soon reclaim the sun's photons all for itself.

Agrivoltaic Solutions' flock of sheep graze near St. Michael's College's solar farm. (Photos: Agrivoltaic Solutions)

Enter husband and wife Lewis Fox and Niko Kochendoerfer, owners of Agrivoltaic Solutions and their flock of 500 sheep. The sheep are helping save the planet one mouthful of grass at a time. The sheep are "living lawnmowers" that are transported from the farm in Leicester, Vermont to various solar installation worksites. In July 2021, Fox, Kochendoerfer, and 60 of their sheep spent a few days at St. Michael's College solar site in Colchester, Vermont. At one acre, it's one of the smallest sites Fox maintains. It's also one of the first college solar array sites to embrace this alternative to traditional fossil-fueled mowing operations.

The EPA estimates lawn maintenance contributes about 4% of CO2 emissions. Additionally, the two-cycle gas engines that power most conventional landscaping tools are serious sources of air pollution and a health hazard to operators, not to mention annoying sonic pollution. A Swedish study determined that an hour lawn mowing creates as much pollution as driving a pickup truck 100 miles.

Encore Renewable Energy owns and manages the St. Michael's site. Barrington Power helped to structure the financing of the project. Besides the pollution, says Amber Lessard, Director of Asset Management and Construction, conventional mowing presents other problems. "The machines are big and there are lots of posts they can't navigate. One day two years ago, Lewis cold called us out of the blue to ask if we'd consider using his sheep. The idea fit very well with our company ethics, so we gave it a try."

Sheep are a perfect match with solar site maintenance. The securely fenced sites provide a ready-made predator safe enclosure. The panels create ample shade for napping. Sheep are small and unlikely to harm any of the equipment. They fit easily under the panels allowing them to access tight areas, such as around pylons, that would require tedious weed whacking by humans. Properly managed with the intensive grazing techniques Fox employs, they are efficient eaters, eager to trim almost everything to golf course standards. The few plant species the sheep don't favor are quickly dispatched by Fox and his trusty scythe.

Fox grew up on a dairy farm near Middlebury, Vermont but ended up in New York state managing dairy farms there. Kochendoerfer is originally from Bavaria and was previously a shepherd of a large commercial flock in Eastern Germany. In 2017, they acquired some sheep. Seeking a way to bring some added income to the farm, they began a sheep mowing operation. It proved so successful that, along with partner farms in New York, the enterprise now has 1,700 sheep grazing 24 sites in VT, NY, and PA.

Fox's enthusiasm led him to co-found the American Solar Grazing Association (ASGA), which focuses on helping farmers and solar site developers work together. Lessard is on the ASGA board of advisors. She is excited at how much interest is growing for this practice in her industry, noting that ASGA provides the expertise to make the partnerships successful. "ASGA knows how to design systems with solar grazing in mind."

According to an article in St. Michael's news by staff writer Mark Tarnacki, "Fox urges other farmers to look into the opportunity of merging agriculture and solar energy since it can be a significant income stream for farmers and a good way to have a symbiotic relationship, so it's something we're excited about."

Fox, Kochendoerfer, and Encore are pioneers in a global movement broadly called agrivoltaics that strives to keep the farm in solar farming. According to a 2019 article in Wired magazine, there were several hundred agrivoltaic projects around the world, over 1,000 in Japan alone. They quote Max Trommsdorff from the Fraunhofer Institute for Solar Systems, observing, "Just eight years back there was almost nothing globally." The Institute studied a project in Germany called APV-RESOLA and found combining solar panels with cropland "results in a rise in land-use efficiency of more than 60 per cent [a measure of the total productivity of a unit of land] while maintaining 80 per cent of crop yield."

"Agrivoltaics creates a positive relationship between solar and farming," Lessard said. "We aren't just taking land for solar away from farming. It's no longer an either-or conversation."

Michael J. Daley is a life-long renewable energy educator and advocate, except for a brief time in high school when he though nuclear power was cool. He lives in a tiny off-grid cabin in Westminster, VT with his wife, Jessie Haas. ♻

Oil and Humans, Part 2

Janis Petzel, M.D.

How did we go from tens of thousands of years of simply collecting pitch from naturally occurring tar pits, to the mass extraction and production of petroleum products in the past 150 years? It may have been responses to a pandemic—The Black Death in the 1300s-- that set forces in motion.

Historically, the aftermath of wars and pandemics are times of major social change. The poor and downtrodden have a moment of opportunity when the need for labor is great, to take back some control for themselves before the rich and powerful clamp down again.

Little spinner in Globe Cotton Mill, Augusta, Georgia. Overseer said she was regularly employed.(Lewis Wickes Hine, January 1909, U.S. Library of Congress)

In Part 1 of this series, we learned that people have been using pitch, tar or bitumen from oil seeps since at least Paleolithic times 40,000 years ago. The oil was used for hand-made objects, medications, or waterproofing, without industrial modification.

Water-powered mills provided power for mechanization from the time of the ancient Greeks (250 BC) and for the next 2000-plus years. By the seventh century A.D. in Ireland and all over Europe by 1300, water-powered mills were used for tool sharpening, grinding grain or malt, making lumber, or "fulling" fabric (pounding wet fabric to compact it). Most of these small industries were in rural areas on streams and were owned by independent trades people. Think of the bawdy miller in Chaucer's Canterbury Tales (1400).

Because of the loss of life during the bubonic plague in Europe starting in 1347, existing power structures weakened. The Church's interventions were useless against a bacterium. There weren't enough people to do manual labor or to farm. Wages rose. Land prices fell. Laws intended to keep the poor under the thumb of the landowners led to revolt. Power and authority shifted. In western Europe, serfdom disappeared by the 1500s.

But the rich have ways of staying rich. Wind-powered ships allowed a new wave of exploration and exploitation. European powers took violent control of the lands of independent people all over the globe. The slave trade started in the 1560s, expanding rapidly in sugar plantations in Caribbean colonies in the 1640s. The oppressive plantation system for growing cotton came next in the southern American colonies. The British textile industry boomed, with textile exports increasing by 800% from 1739-1759. Slavery in the Americas kept pace.

From the mid-1600s onward in Britain, changes in the way common lands were distributed, animal breeding advancements, and the development of four-year crop rotations including nitrogen-fixing legumes, lead to food surpluses. (We're still making use of these ideas today in the organic farming movement).

But even good progress can have unintended consequences. The food supply fed a population increase in Britain and Wales (1700: 5 million; 1801: 9 million; 1901:32 million). Population growth started to outstrip food supply by 1770. Sugar became a major source of calories as people moved from rural areas into cities for work. Thus, one evil (slavery) fed another (overpopulation and increasing poverty) and increased a third (wealth increasingly in the hands of the few.). Finance and banking institutions started in this period.

In 1760, James Watts made improvements to the coal-burning steam engine, which changed everything. Coal drove the Industrial Revolution and also became the dominant fuel for heat, rather than wood.

So, it was coal, not oil, that powered the shift from rural, agrarian manufacturing to an urban phenomenon, all on the backs of slave labor and the poor. Think of Charles Dickens's novels, and you can visualize the filthy air, cramped, disease-ridden poverty that ensued.

Then coal-powered steam engine begat the Petroleum Age in America.

Based on these observations, this writer has developed a hypothesis. It is that healthy public policies create a healthy human ecosystem, while diseased decisions and actions lead to ever-increasing dis-ease in society. Our dependence on fossil fuels is a symptom of the greater disease of greed and inequality.

In the next issue in August, we'll talk about the birth of Big Oil.

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

Janis Petzel, MD is a physician, grandmother and climate activist whose writing focusses on resilience, climate, and health. She lives in Islesboro, Maine where she advocates and acts for a fossil-fuel-free future. She serves on the Islesboro Energy Committee and is a Climate Ambassador for Physicians for Social Responsibility. ♻

Elmore Roots' Permaculture Know-How

Fast Food

David Fried

I go out for fast food almost every day. I go out to the garden.

Here by May 24th the asparagus has grown about two feet tall in the last five minutes.

I snap them off low, just where they naturally bend and separate them as I walk down the row taking one after another.

I eat one or two right away and bring the rest home. I spread them on a tray, drizzle with olive oil and sea salt and pepper and broil them for eight minutes until tender. Yum.

Perennial fast foods of asparagus and rhubarb grow at Elmore Roots Nursery (Courtesy photos).

A few feet behind me is a row of red rhubarb stalks. I reach to the base and twist the glowing crimson red stem with the light coming through, and it quickly separates clean from the mother plant. I leave one third of the stalks to make its own food from the sun and mine for next spring.

My 83-year-old neighbor friend finds some rhubarb stalks on his porch tonight. The next day, like a little boy remembering something wonderful, he said, "You know what I'm going to have tonight. It's sitting on the shelf right now!" (His wife made him a pie.)

I ask him if he knows that some people refer to rhubarb simply as "pie plant?"

I quickly pull green upright leaves off the row of sorrel plants. They come back every year, and I don't have to do anything except give them a little compost around their base every few years.

I take the leaves home in a plastic bag and toss them into a red lentil soup my wife made a few days ago, and there are a few jars of it in the fridge for dinner meals during the busier part of the week. The sorrel adds a wild and lemony taste to the soup, and these greens wilt down quickly as the soup heats up on the stove. I add some sour cream to my bowl as I serve it at the table, because that is how my father liked it. He would buy jars of this soup at the store and it was called "schav." Sorrel soup. It was a staple in our cupboard next to the same size tall bottles of borsht.

These three have been my great stars for years, and I cherish these rows of perennial fast foods. I can count on them every spring. No replanting. No starting them indoors. No tilling or forking the earth. You just turn around, and they are ready to harvest and enjoy. I'm sure they are good for you, too. They used to grow on every farm and at the edge of every garden in Vermont.

Some good ideas our grandparents had we can still bring back. Fast. We can nourish the earth and ourselves at the same time. Ah, yes. Soon the haskap berries and currants will be ready for plucking and feasting on, in the berry patch a few rows over, come early summer.

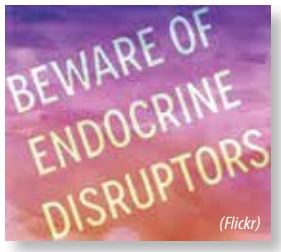
David Fried is the propagator and grower at Elmore Roots Nursery and is very proud of his perennial vegetable rows. ♻

Larry Plesent

Ingredient of the Month

Endocrine Disruptors

in our Modern World



Hormones are chemical messengers that signal cells to do things. Humans and all animals, plants, fungi and even bacteria produce similar hormone messenger molecules. Hormones tell our bodies to change as we go through life's stages and respond to stimuli. Most of what we call "feelings" or "moods" are hormonally induced changes that might include altering your heart rate and blood pressure.

It takes a ridiculously tiny amount of a hormone to create a big change. When I say tiny, I mean tiny as in a few parts per million tiny. This is roughly on par with a speck of dust floating through your house. This is because a hormone is usually simply the messenger.

Large amounts of hormones sometimes produce the exact opposite effect that small amounts have. For example, the drug cocaine inhibits the "off mechanism" that tells your body to stop producing dopamine, while simultaneously telling your brain to produce more of it. Dopamine quickly builds up in your body, often producing an intense temporary "rush."

Dopamine is the feel-good hormone that we make in response to successful task completion, sunsets and fuzzy cuddly things with big eyes. However, too much dopamine floating around your body produces distinctly non-feel-good sensations including paranoia, anxiety and panic. This is a very different suite of sensations from the feelings of pleasure and euphoria and wakefulness sought by users of cocaine. If you want to scare yourself, look up the effects of long-term cocaine use on the brain and body. Too much happiness hormone Is not a good thing.

This then is the back story to this issue's missive. Hormones' messengers are produced and consumed by all living things including us, and we evolved to function and thrive in this environment. Hormones are powerful in very tiny amounts, affecting our bodies and our emotions. Larger amounts of a hormone usually have the opposite effect.

Now here's where things get truly wacky. It turns out that our current state of civilization produces a veritable witches brew of unintended toxic by-products. Some of these are actually identified by our bodies as hormones. Scientists call them endocrine disruptors, and they are a huge obstacle on our path to ever greater convenience. According to the National Environmental Institutes of Health's (www.niehs.nih.gov) web site, "Endocrine disruptors are found in many everyday products including some plastic bottles, liners of metal food cans, detergents, flame retardants, cosmetics and pesticides."

How about a yoga class on the beach to release those everyday stressors? (Kaylee Garrett, Unsplash, bit.ly/3HhhCS4)

What do beer cans, tomato paste, tires, new car smell, many fragrances, children's toys, medical devices, furniture foam, hydraulic fluid, soy beans, triclosan, vehicle exhaust, cigarettes, dental floss and water in clear flexible plastic bottles all have in common?

ALL of these diverse and common accoutrements of our civilization contain endocrine disruptors. Taken all together it is very difficult to parse which staple of the economy and modern lifestyle is causing what ailment. In the face if this hormonal mimicking onslaught, what can you do as an individual to protect yourself from hormonal pollution?

First off, never drink plastic water. If it smells and tastes like plastic, you are getting poisoned. The thinner, more flexible and clearer the plastic the more you are getting poisoned. Plastic water bottles are bad for you, and they are bad for the planet. If you care about your body and the body of the earth, just say no to plastic water. Forever. Please and thank you.

Eat mostly organic food. USDA certified crops are audited natural, from farm to package. Organic farming methods trap carbon in the soil, produce less pollution and use few pesticides and herbicides. The pesticides and herbicides that are used include soap, mulch and burning. Any chemical inputs are few and far between and must completely break down within three days. Organic farms have a lower chemical load, higher nutritional value, and trap carbon, which contributes to the current global warning trends.

Organic farms never use hormones. Growth hormones have been banned by the European Union since 1998 and banned from Australian poultry since the 1960's. Even tiny amounts of a hormone can produce big changes.

Daily physical exercise helps to normalize your hormonal balance. Develop a program that works for you and stick with it. Do a mix of both hard and steady exercises to get full benefit. Use it or lose it. You've got to move that body!

Stress is a huge influence in our lives and in our bodies. Stress kills, and it does it hormonally. Yoga, meditation, painting; whatever works for you, do it every day and you increase the likelihood of living a longer, healthier and more hormonally balanced life.

Right now, there is a worldwide movement to reduce single-use plastics. Be part of that change to a more sustainable, reduced plastic future. Your hormones will thank you for it.

Larry Plesent is a writer living in the Green Mountains of Vermont. Learn more at www.vtsoap.com and www.reactivebody.com. ♻

RESOURCES

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

Vermont Passive House: www.vermontpassivehouse.org/Resources/

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

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ADVERTISERS INDEX

Agriculture and the Habit of Eating Meat—Paths to a Healthful Future

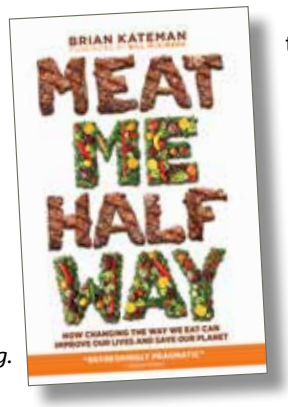
Books reviewed by Janis Petzel, MD

Meat Me Halfway—How Changing the Way We Eat Can Improve our Lives and Save Our Planet

by Brian Kateman. Prometheus Books, Guilford, CT 2022.

Farming for Our Future-The Science, Law and Policy of Climate-Neutral Agriculture.

Peter H. Lehner and Nathan A. Rosenburg. Environmental Law Institute. 2021.



When I was a resident in psychiatry back in the 1990s, I used to moonlight in a mental health crisis unit in Norfolk, Nebraska. The little town's claims to fame were being the hometown of Johnny Carson, and its multiple cattle feedlots. Nebraska is a little hillier than people think it is, but not by much. Before I reached Norfolk, I could make out what looked like a mountain on the outskirts of town. An atrocious smell hit me through the closed car windows before I could see the mountain, even in below-zero temperatures in January.

By the time I hit the Norfolk town limits, I could see that the mountain was a massive pile of cow manure, with live cattle standing knee deep in their own poop on top of it, their sides and legs coated with excrement. It's hard to imagine that the manure could be removed before the animals went to slaughter. Between the smell and the thought of how much cow poop was in food, I would come home from a weekend of work determined to be vegetarian.

That resolution would last for various periods of time, but inevitably, we'd fall back to the menu pattern I learned from my mother: meat, starch and a veggie on the plate for dinner. As it turns out, our family was not alone. Many people with good intentions fall off the vegetarian wagon.

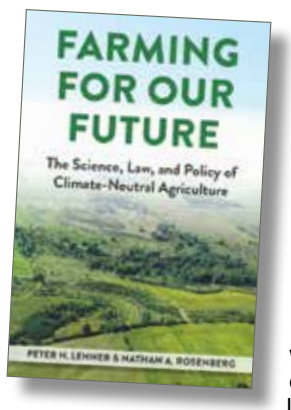
Brian Kateman, the originator of the "Reducetarian" concept which advocates eating less meat, provides reasons for this carnivorous urge. He notes in *Meat Me Halfway*, that even before Homo Sapiens had evolved, our relatives on the Homo branch of the evolutionary tree were eating meat at least 2.5 to 3 million years ago. Kateman traces the difficulties many people have in giving up meat, due to habit, marketing ploys, economics, and a preference for our bliss-generating response to fats, sugars and salt.

Industrial Agriculture Produces a Vast Amount of Inexpensive Food

- 430 billion pounds of food produced annually*
  *3,683 calories/person/day (~2,200 recommended)
- 20 mm bales of cotton, 20 mm pounds of wool, 14 bb gallons of biofuel
- 20% of food produced exported; 15% imported; 40% is wasted
- Farmers receive 7.8¢/food dollar

Source: Earthjustice

Far from being a diatribe on the dangers of eating meat. Kateman's book takes an even-handed look at health and human history both ancient and recent, in sections titled "Rise of Carnivorous America, Why We're Still Hooked on Meat Today," and "Meat of the Future" (the most disturbing but hopeful section). I used to work in a biochemistry lab growing cells in tissue culture. The idea of eating lab-grown meat is difficult for me to contemplate. But apparently, it tastes good and is way less damaging to the environment than current Big Ag methods. I need to have a more open mind.



The book was an enjoyable read. Kateman is an engaging writer. He makes his factual material relatable by interspersing personal stories. He ties together all kinds of interesting historical tidbits linking the abundance of meat in Colonial America, the influence of technology such as refrigerated rail cars, and federal subsidies, the impact of demand for shelf-stable meat during the World Wars, all leading to the fast-food lalapalooza that is America today.

Kateman quotes Sigmund Freud on the "narcissism of small differences" which leads groups who have much in common to reject and look down on each other. An example is of some vegans who are more dismissive of ovo-lacto vegetarians than of people who eat meat. Kateman cautions that large scale husbandry of animals for meat and profit, such as in Confined Animal Feeding Operations (CAFOs), are the enemy, not each other. People concerned about health, ethics, animal welfare, and the environment must avoid infighting and work together to make change.

If you're looking for ways to do that, Peter Lehner and Nathan Rosenberg's *Farming for Our Future* is an invaluable source. Both authors are affiliated with Earthjustice and at various times with the National Resources Defense Council. The book is dense with data and policy ideas. If you're a person who writes letters to the editor or who communicates with your legislators, this book will help you see the big picture and offers potential policy solutions.

If you'd like an easier to digest introduction to Lehner and Rosenberg's ideas, you can watch a YouTube of Lehner's presentation at a Maine Conservation Voters Lunch and Learn on April 8, 2022 (https://bit.ly/YouTube_Lehner_AgandClimateChange). I bought the book after I heard his talk.

Knowing the history and seeing a path to a better future is motivating to me, and I hope for you. These books are worth your time and money, as is supporting small farmers using sustainable agriculture methods. Next stop for me: to the library for vegan cookbooks. I don't intend to be vegan 100% of the time, but I do plan to try a new way of looking at what goes on my plate.

Janis Petzel, MD is a physician, grandmother and climate activist whose writing focuses on resilience, climate, and health. She lives in Islesboro, Maine where she advocates and acts for a fossil-fuel free future. She serves on the Islesboro Energy Committee and is a Climate Ambassador for Physicians for Social Responsibility. ♻

Low-Income Housing that Works

Cont'd from p. 30

connected or stand-alone garage, should provide room for ample storage outside and living inside. Smart kitchen-dining areas design can provide all the amenities in a small space. Creating accessible storage spaces under stairs and over cupboards optimizes the use of space, as do multipurpose rooms like office-bedroom spaces.

Another Zero Accessory Dwelling Unit in Bend, Oregon provides affordable small, well-designed living spaces with no energy bills. (Joe Emerson)

Our Experience

We decided to add ADUs to our two small rental homes on two different properties in Bend, Oregon, where the city changed the zoning code to allow ADUs. We conducted energy modeling to determine the least-cost path to zero. We sealed the building envelope using **Aerobarrier** and insulated it well. We used a small heat pump mini split for HVAC and a small heat pump water heater, used one Panasonic Whisper Quiet ERV in the bath and one in the kitchen, and installed energy-efficient electric appliances, including an induction stove. We added generous unconditioned storage areas outside of each unit. Because neither of the existing small homes had a good solar orientation and the ADUs did, we added enough solar on each of the ADUs to power both the ADU and the original house on each lot. So, they both became zero energy homes.

Perfect for Low-income Housing

We can profit from rents while the tenants enjoy no energy bills. We have rented out two units, with two more on the way, to people with low incomes, referred by local non-profit organizations, providing them with affordable small, well-designed living spaces with no energy bills.

Joe Emerson is the founder of the Zero Energy Project.

Reprinted with permission from Zero Energy Project's March 14, 2022 blog at https://bit.ly/ZeroEnergyProject_ZeroAccessoryDwellingUnits. ♻

Monadnock Food Co-op Announces 2022 Farm Fund Grant Recipients

The Monadnock Food Co-op of southwestern NH announces six grant recipients for the 2022 Monadnock Food Co-op Farm Fund: Picadilly Farm, Partners' Gardens, Grow a Pear Farm, Flying Cloud Dairy, Brookfield Farm, and Green Wagon Farm. The Farm Fund proudly distributed $32,000 among these farms. Since starting in 2017, the Monadnock Food Co-op Farm Fund has awarded over $119,000 in grants to 17 local farms.

Picadilly Farm, a diversified farm in Winchester, NH, selling organically grown vegetables, will upgrade the cooling system of one of their walk-in coolers. This upgraded system will allow them to extend late winter and early spring sales of their storage crops.

Partners' Gardens, a small-scale diversified farm that sells produce grown using organic practices in Nelson, NH, will install a 50-foot movable caterpillar tunnel. This infrastructure will allow them to harvest their greens earlier in the season, as well as harvest more fall greens as their season ends. During the middle of the season, the caterpillar tunnel will provide protected space for delicate vegetables such as cucumbers and tomatoes.

Grow a Pear Farm, an orchard that grows using organic practices and currently sells 34 varieties of rare heirloom apple trees in Charlestown, NH, will work with a local contractor to install wildlife exclusion fencing around the perimeter of the orchard. This fencing will allow the orchard to expand to 250 fruit trees while protecting trees from deer to ensure continued tree growth and fruit production.

Flying Cloud Dairy, a producer of fresh milk, yogurt, as well as hay, and beef in Alstead, NH, will update its milk cooling tank to ensure product stability. Upgrading to a new cooling tank will allow increased production and more time for deliveries. The upgraded tank will also increase energy efficiency.

The Wooster family of Picadilly Farm is one of the Monadnock Food Co-op Farm Fund grant recipients. (Scott Hussey)

Brookfield Farm, an organic dairy and beef producer in Walpole, NH, will upgrade its transport cooler system for frozen meat sales. Upgrading this system will increase sales by allowing for further transportation to farm stands and a new delivery service direct to their bulk customers.

Green Wagon Farm, a diversified farm that sells produce in Keene, NH, will install a third walk-in cooler at their retail farm stand in Keene. This new cooler and the upgraded system will allow for better storage of crops to increase sales, efficiency, and sustainability.

The Monadnock Food Co-op Farm Fund, created in partnership with the Cheshire Country Conservation District, has a mission to support local farmers in increasing sustainable food production and wholesale sales to contribute to a thriving local farm economy. This grant supports several of the co-op's goals, including contributing to a healthy, sustainable food system, supporting local farmers and producers, and building a strong, sustainable, and improving local economy. The Cheshire County Conservation District, fiscal agent and partner for the Farm Fund, supports farm viability in the region and promotes the responsible stewardship of natural and agricultural resources.

"Our Farm Fund is an essential way to invest in the future of local, sustainable farming in our region," said Michael Faber, Monadnock Food Co-op General Manager. "Especially in these times, it helps ensure we have a healthy, local food system for our community now and into the future."

Funds for this program are provided by donations from Monadnock Food Co-op and its shoppers. Additional funds come from the You Have Our Trust Fund.

Fundraising is already underway for the 2023 Monadnock Food Co-op Farm Fund grant cycle. During May and July 2022, co-op shoppers can round up their change at the registers to donate to the fund. So far this year, shoppers have contributed over $11,000 to the Farm Fund.

For more information, please visit monadnockfood.coop/farmfund. ♻

Many thanks to our sponsor:

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Ithaca's Aggressive Decarbonization Plan

Green Energy Times Staff

This is a short summary of a story that came out in Utility Dive*, which is a free online newsletter. The headline is sure to catch your attention:* ***"Inside Ithaca's plan to electrify 6,000 buildings and grow a regional green workforce using private equity funds".*** *The city has mustered $105 million in private funds to support low-cost loans for businesses and residents to install heat pumps.The city's decarbonization plan is among its most ambitious efforts ever. It may be an example for many more rural communities. Read the full story at (https://bit.ly/Ithaca-electrify-6000-buildings).*

The City Council of Ithaca, New York, voted last November to decarbonize and achieve net-zero emissions by 2030. The vote created quite a stir, with many people saying it just could not be done.

Estimates of the number of buildings that need to be retrofitted with better weatherizing and given new heat pumps range from 6,000 to 8,000. Achieving the goal will cost about $600 million. That's a lot of money for a city of 30,000 people.

Building Decarbonization Coalition Executive Director Panama Bartholomy, a person deeply involved in the project, pointed out that there are groups in just about every city in the United States working on the problem of decarbonization. They are all trying to find a model showing how to do this seemingly overwhelming job.

Making the decisions on how to replace heating and cooking units for a single building is really not very challenging. On the other hand, creating a financial model that can make the whole job work economically is not at all easy. It happens that Cornell University faculty members are working on a model to address the financial issues.

Fortunately, there are private organizations that are getting involved. With the data provided by the modeling, they can see a 3% to 4% return on investment, which some consider attractive. Also, there are state and federal funds that will make the finances easier.

This job will clearly have an important effect on employment in the area, as it is estimated that the number of people who can install the heat pumps and other equipment will have to be multiplied by six or more, with hundreds of jobs being created. ♻

100% Clean Energy Goal – Cont'd from p. 21

and that the whole country can move faster towards clean power."

With passage of Maryland's Climate Solutions Now Act in April, more than 170 million Americans live in a state or other U.S. jurisdiction committed to transitioning the economy to energy sources that do not emit greenhouse gasses into the atmosphere. These commitments are helping to drive the rapidly increasing market penetration of solar, wind, battery storage, and other technologies.

Nevada Gov. Steve Sisolak, leader of a state with a 100% commitment, said, "Nevada has long led the way in fighting climate change by investing in clean energy – it's how we became the solar capital of the country. Now, nearly half the states and over half the population of the United States share Nevada's ambitious target of 100% clean energy. I'm confident our representatives in Washington, D.C. can fully fund a secure and prosperous American energy economy of the future."

The states vary in their 100% goals. Some are focused exclusively on renewable energy sources such as solar and wind. Some of the states have goals that focus exclusively on the electricity sector, while others are seeking economy-wide carbon neutrality.

But all of the states have embraced goals that require and are leading to meaningful action. The states are making concrete, detailed plans and strategies for how to achieve their goals. Eleven states have already published their plans, most of which are summarized in *CESA's Guide to 100% Clean Energy States* (https://bit.ly/CESA-guide-clean-energy).

As a new Union of Concerned Scientists report shows, the additional health and economic benefits of moving rapidly towards 100% clean power are seriously significant. Benefits also include thousands of fewer deaths from air pollution, more than 100,000 fewer cases of exacerbated asthma, and hundreds of thousands of new jobs.

Through the 100% Clean Energy Collaborative, CESA, in partnership with the U.S. Climate Alliance, is tracking the trend towards 100% clean energy among states and helping those states achieve their goals. ♻