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East Coast Sea Level Rise Fastest in the World

N.R.Mallery

For the September 22 edition of NPR's "Fresh Air," Terry Gross interviewed Brady Dennis about climate change. The show was titled, "Extreme heat, flooding and wildfires: How climate change super-charged the weather," and it can be heard online at <https://n.pr/3Cme3JJ>.

Brady Dennis is an environmental reporter for *The Washington Post*. He has written extensively about climate change. While he spoke of fires and droughts on the "Fresh Air" broadcast, the thing that may have really stood out for those who live in the Northeast was the issue of rising sea levels and floods.

Green Energy Times has visited the issue in the past, but it is not something that can be stated once and left alone. For one thing, both the sea level rise and knowledge of it are changing.

Melting ice from glaciers and polar regions has already caused the sea level to rise. We have had a fairly accurate understanding of this in recent decades because satellites can measure the rise by satellites for nearly all ocean areas, with small margins of error.



Sandbags protecting the eroding east coastline. (Adobestock/69295946_digidreamgrafix)

What the measurements show is very close to what scientists expected, given the amount of ice that has melted. For us in the Northeast, the east coast of the United States is one of the areas in the world where the seas are rising fastest, according to Brady Dennis.

According to Climate.gov (<https://bit.ly/3j5T0yv>), the sea level has risen by eight inches since 1880. That might not sound like much, but when the consequences are considered, it becomes clear that it is quite a lot.

For example, a search of internet sites tells us that sandy beaches have slopes ranging from 1% to 8%. If we take an

Cont'd on p.18

Renewables Survive Cat 4⁺ Hurricane!

Beating a Hurricane with Solar and Batteries!

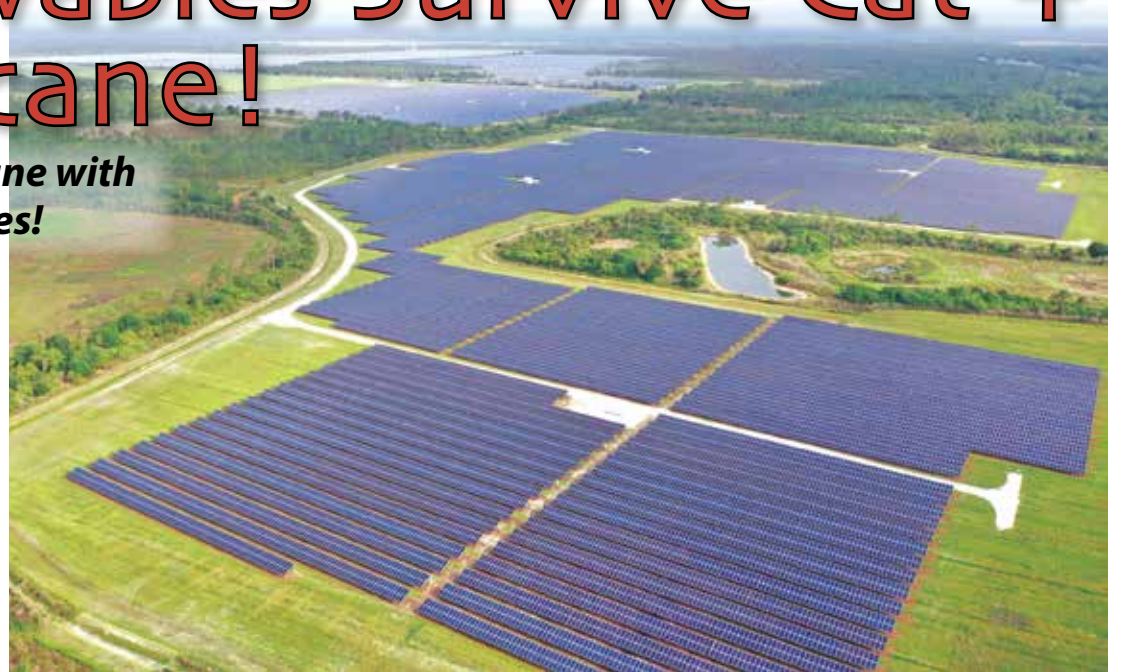
George Harvey

The sun doesn't always shine, but so what?

Hurricane Ian didn't prevent solar power and batteries from providing electricity 24/7 while it shut down the grid in Southwest Florida. The big thermal plants just could not deliver electricity on the failed grid, but the people in Babcock Ranch (BR) were living a rather normal life, in terms of their use of electricity.

Some people say we need baseload power plants for reliability, but the baseload plants had to shut down in the power failure. And as they showed us once more how unreliable they can be, the solar-plus-storage system at BR showed how well things can run.

Baseload power plants, whether they burn fossil fuels or react nuclear fuel, are vulnerable in ways that solar power and batteries are not. Baseload power plants are designed to deliver electricity at full



The community of Babcock Ranch, just outside of Fort Myers, FL, never lost power when hurricane Ian devastated the area. (FPL)

power or not at all. Without the load of an active grid, they have to shut down. And when they shut down, it can be a long time for them to get back to full power. They have problems that a combination of solar power with batteries doesn't have. And with those problems, there are reliability issues.

BR was designed and built for resilience. Among other things, this meant

that the buildings were all designed to be difficult to flood. They were also designed to withstand the winds of major hurricanes.

The designers of the community got Florida Power & Light (FPL) to install a solar-plus-battery system that would support the 2,000 homes, with enough extra power that it would be sending more power to the grid than it

Cont'd on p.7

Inflation Reduction Act Marks Biggest Climate Investment in U.S. History

Bob and Suzannah Ciernia

After years of writing letters to the editor, calling and emailing our elected representatives, and lobbying in person, Citizens' Climate Lobby (CCL) is proud to take some of the credit as one of many environmental organizations that helped move legislators to include significant spending to address climate change in the recently passed Inflation Reduction Act (IRA).

The bill itself is a massive collection of programs and policies that range from allowing Medicare to negotiate drug prices, to paying farmers for sequestering carbon in their fields. As climate activists, we will focus on those parts of the landmark legislation that tackle climate change.

For starters, the IRA will help reduce the country's carbon emissions 40% by 2030. That is close to the U.S. commitment of 50% made at the Paris Accord – but not all we were working for.

As shown in the graph, the U.S. was on track to cut emissions just 27% below 2005 levels by 2030, or halfway short of the 50%-by-2030 pledge.

The Environmental and Economic Benefits

The IRA is going to initiate change that environmentalists have been talking about for years, and a bonus is that most American pocketbooks will be improved at the same time.

- A fee on methane pollution in combination with EPA methane regulations will curb emissions from the oil and gas industry by about 70% by 2030.
- By accelerating the transition away from dirty fossil fuels toward clean energy, the bill will significantly reduce air pollution. Based on analysis by Drew Shindell of Duke University, the pollution reductions from the bill will avoid 180,000 premature American deaths over the next eight years.

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Concentration of CO₂ in the Atmosphere

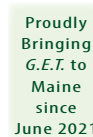
415.52

parts per million (ppm)
October 13, 2022

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port them. Say that you saw them in Green Energy Times. Now
let's all G.E.T. moving ahead towards a clean, renewable future –
one where our children & grandchildren will be able to breathe
& grow, live & love on this beautiful planet where we live.

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minimum. We grow most of our food organically and live as sus-
tainably as possible. We DO walk our talk! Peace!

LETTER FROM THE EDITOR

What crazy times we are living in! The
climate is changing faster than scien-
tists thought, sea levels are rising, and
storm systems are stronger and more
frequent than in the past. Then, we have
an impending winter just ahead of us with
the ever-increasing costs for fuel to get
around or to heat our homes.

Enough said about all the scary stuff.
Green Energy Times is not about the prob-
lems, it is about the solutions.

Talking about solutions, how about
the Inflation Reduction Act (IRA)? There is
much available now and starting in 2023
that includes solutions for help with the
rising costs of fuels for transportation and
for heating and weatherization, renewable
energy, energy-efficient appliances and so
much more. You will read many articles in
this issue explaining the way the IRA can
apply to you.

I mentioned rising seas, and the seas
ARE rising and the east coast of the U.S. is
going to see the rise the soonest and more
than the rest of the world. See our front-
page article about it if you haven't already.
Think about that — the largest population
in the country lives on the east coast. Do
you expect climate migration to hit inland
in the northeast hard? Vermont groups
are concerned about how we are going to

be able to handle it all while taking care
of the needs of those already living here.
New Hampshire, New York and Maine
will all need to make plans to accommo-
date the increasing needs for many more
people who may be displaced. We all need
to become climate-resilient. That is why
we work so hard to bring G.E.T. to you all
(and do it for free).

Speaking of free, donations are ap-
preciated and helpful to keep our efforts
to provide you all with solutions in G.E.T.
Remember to add a subscription of G.E.T.
to your gift-giving list. It is our sincere
hope you find many solutions as you read
the information on the pages of this and
every edition. We hope you all will be-
come climate resilient as we face our scary
future. Each topic in G.E.T. is important to
help each of us to find ways to deal with
the changing world around us. Please read
and learn and do more for yourself and
the planet.

Happy fall! Happy holidays!
Be well, find happiness as you
achieve your goals and know
there is hope IF we make
the changes for a sustain-
able future for us all.

– Nancy Rae Mallery,
Editor, Green Energy Times



Kudos to the Green Energy Times Team
Helping G.E.T. Save the Planet

G.E.T. staff

Michelle Harrison is
G.E.T.'s Coordinating Direc-
tor and Advertising Sales
Representative.

Asked about her expe-
rience, she told us, "Since
working with Green En-
ergy Times, I have learned
a lot about living sustain-
ably. My husband and I
installed a ground-mount
solar array. It was quite
the undertaking, but we did it! It is so great to be
free from the high electric rates in New Hampshire.
We compost which helps keep our trash bin hardly
full for the weekly pickup. We participate in recycling
of everything we can. Our garden helps to keep
our refrigerator full of vegetables over the summer



The DIY solar array that Michelle and her husband
installed in their back yard. (Courtesy photo)

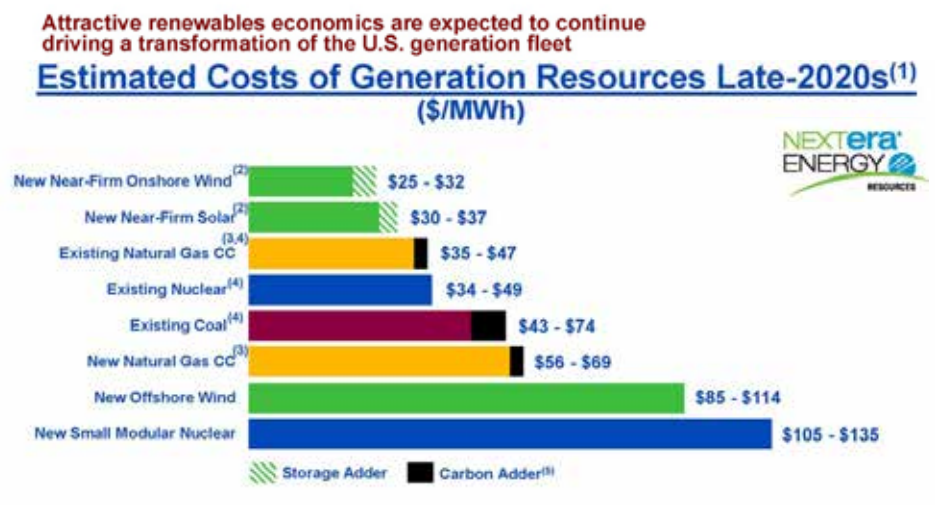
months and reduce our
trips to the grocery store.
We recently replaced our
17-year-old car with an
electric car and could
not be happier. We drive
guilt-free and charge it
with our solar array! It is so
nice and convenient to be
able to recharge your car
at home and not worry
about all the maintenance

costs and headaches of gasoline vehicles.

"We love the concept of keeping things simple. All
of these projects happened over a course of six years.
We do what we can when we can. We hope everyone
does their part, too! We are sure you will be as happy
with your sustainability projects as we are." ♻️

RENEWABLE ENERGY IN THE NEWS

G.E.T. staff



Renewable energy is taking over the markets.

One truly fascinating item is in the NextEra inves-
tor conference report, which can be viewed online
(https://bit.ly/NextEra-report-2022). We might remind
ourselves that NextEra Energy owns seven nuclear
power plants and a number of gas and coal plants.

The NextEra report is basically a long slide show
explaining to investors what NextEra is planning for
the upcoming several years. On page 122, there is

an interesting graphic (shown above) that compares
the expected prices for electricity NextEra expects
to see for the coming several years. It explains why
NextEra will adopt more renewable capacity instead
of extending its use of fossil fuels and nuclear energy.

On this graph, please note the bars for "near firm"
solar and "near firm" wind. The term "near firm" means
the resources can produce power on demand, 24/7,
just as nuclear or gas plants do,

Cont'd on p.14

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Vermont Not on Track to Meet 2030 Climate Requirements

Jared Duval

A new report from the non-profit Energy Action Network finds that Vermont is not on track to meet its legally mandated emissions reduction requirements under the Global Warming Solutions Act.

“While there is a lot of important information in this comprehensive, 40-page report, a key takeaway is that Vermont is not on track to meet our emissions reduction commitments by 2030,” said Jared Duval, Executive Director of the non-profit Energy Action Network and the member of the Vermont Climate Council appointed to provide expertise in energy data and analysis. “A big reason why is that Vermont has so far failed to adopt at least one of the policies that have been proven by other states and countries to provide a high degree of confidence in reducing emissions—emissions caps or performance standards—for our two most fossil fuel-intensive and climate polluting energy sectors: transportation and heating,” said Duval.

In contrast, for the electricity sector, Vermont has already adopted an emissions cap policy (the Regional Greenhouse Gas Initiative) and a performance standard (the Renewable Energy Standard), which together have helped to drive down emis-

sions from Vermont’s electricity portfolio. However, Vermont’s largely fossil-free electricity portfolio produces only two percent of Vermont’s overall greenhouse gas emissions. Meanwhile, the transportation and thermal sectors together account for nearly three quarters of statewide greenhouse gas emissions.

The report also reinforces the fact that meeting Vermont’s climate commitments is technically possible with existing technology and best practices – and that doing so as modeled by the Vermont Climate Council is forecasted to save

Vermonters’ money. Independent analysis contracted by the Vermont Agency of Natural Resources found that Vermont stands to benefit from \$6.4 billion in net economic savings and avoided damages between now and 2050 by meeting emissions reduction requirements via the pathways outlined in the Climate Action Plan adopted by the Vermont Climate Council in 2021. However, the two most significant policy pillars of the Climate Action Plan (CAP) that could help ensure those targets are achieved—the Clean Heat Standard and the Transportation and

Climate Initiative—have thus far failed to be adopted.

The report comes in the wake of continued international scientific warnings, including from the Intergovernmental Panel on Climate Change (IPCC), which stated earlier this year that humanity has “a brief and rapidly closing window to secure a livable future.”

The burning of fossil fuels is the primary cause of the climate challenge. Only 5% of Vermont’s electricity portfolio comes from fossil fuel generation. However, nearly 95% of Vermont’s transportation energy use is fossil fueled (primarily gasoline and diesel) and nearly 75% of Vermont’s thermal energy use is fossil-fueled (primarily fuel oil, fossil gas, and propane).

The report notes that fossil fuels create both far more climate pollution and are generally more expensive and price-volatile than electricity in Vermont. Therefore, one of the best ways to simultaneously reduce climate pollution and cut energy costs for Vermonters is to efficiently electrify how we get around and heat our homes.

The report states, “Transitioning away from high-cost, price-volatile fossil fuels that are 100% imported towards lower-cost, price-stable renewable alternatives that keep more of our money local can result in a win-win-win for our climate commitments, consumer protection, and economic resilience.”

After the last year of near-record prices for gasoline, diesel, fuel oil, and propane, many Vermonters have been especially challenged by high energy costs. The report details how moving to electric or renewable transportation and heating options can save consumers money on energy. For instance, compared to roughly \$4 per gallon for gasoline, the cost of charging an electric vehicle (EV) is the equivalent of about \$1 per gallon in most of Vermont—and EVs have lower maintenance costs than fossil fueled vehicles. Additionally, federal, state, and utility incentives often bring the upfront price of EVs down lower than the cost of comparable gas or diesel models. The report shares similar consumer data about heating, with heat pump water heaters, heat pumps, and advanced wood heating systems all enabling sizable fuel cost savings and often costing less up front to install than fossil options, after incentives.

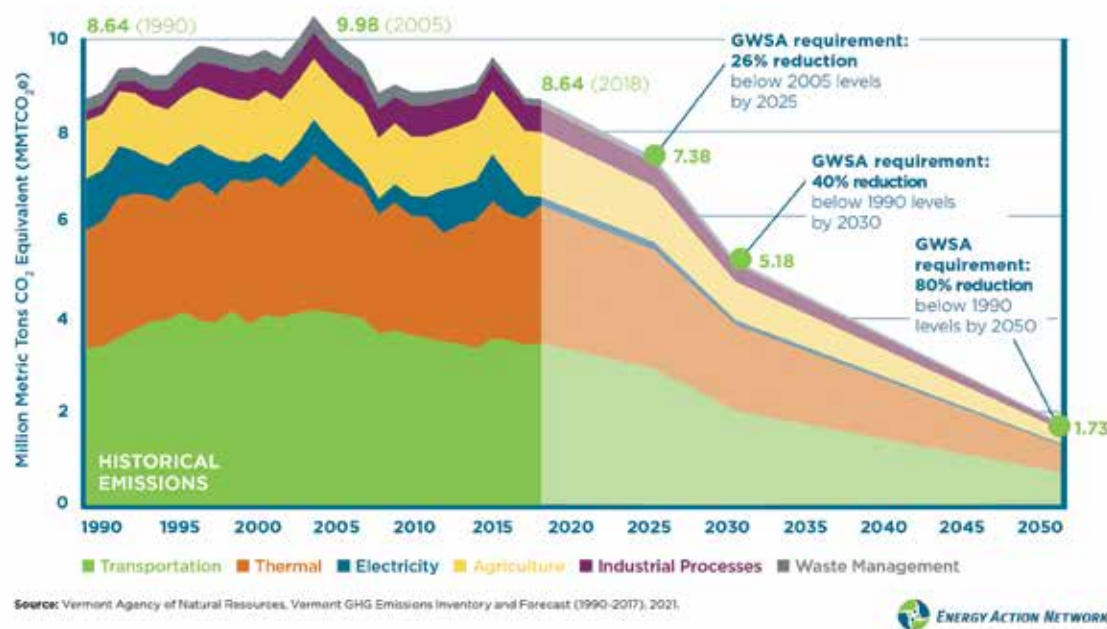
To ensure that all Vermonters can have access to pollution-reducing, money-saving options, the report also emphasizes that policies and incentives need to be equitably designed, prioritizing lower-income Vermonters for assistance, in particular.

“Energy is a complex and nuanced topic that does not lend itself to simple headlines. If you want to more fully understand Vermont’s energy system and where we stand in relation to our state climate requirements, there is no better place to start and no more accessible and comprehensive overview than EAN’s Annual Progress Report for Vermont. What this year’s report is telling us very clearly is, while we have made progress in terms of renewable electricity, we need additional policy action in the thermal and transportation sectors to reach Vermont’s critical climate commitments,” said Darren Springer, General Manager of Burlington Electric Department.

To read the full report, visit: <https://www.eanvt.org/2022-EAN-report/>

Jared Duval is the executive director of the Energy Action Network. ♻️

Vermont’s historical GHG emissions and future requirements



The Inflation Reduction Act Just Shattered the Ceiling for Clean Energy in Vermont

Peter Sterling

Incredibly and finally, the Inflation Reduction Act (IRA) has begun the shift to a clean energy America. For the first time ever, the massive resources of the U.S. Government will be mobilized to move our country off of climate change causing fossil fuels and onto renewable energy sources like wind, solar and hydro power.

We are finally looking at a future where renewable energy and other pro-climate technologies will benefit from a level of government support comparable to what the fossil fuel and nuclear industries have received for decades. For the first time there will be an energy storage tax credit, a comprehensive EV tax credit, a long term commitment to a solar tax credit for homeowners, and extra incentives for renewable energy businesses that pay prevailing wages and help to build solar equipment in the U.S.

What does this mean for Vermonters? A lot. First, if you are looking to go solar, you will now get 30% off through a tax credit. Tax credits and rebates will also be available for those who want to make their homes more energy efficient and get rid of their fossil fuel burning cars and appliances in favor of electric alternatives.

Maybe the biggest game changer of all is that energy storage is now much more affordable. Here in Vermont, we make a lot of solar power when the sun is shining. Sometimes, so much that this solar power is sent back out on the New England-wide power grid for other states to use.

But when the sun goes down, we end up having to buy power back from this grid, power that is predominantly generated from natural gas and nuclear but also from coal and oil, especially during energy use spikes. With newly affordable energy storage, Vermont should be able to “save” our excess solar which we make during the day and tap into it at night or during peak usage periods.

Another benefit from the adrenalin shot of the IRA, Vermont should be able to receive 100% of its electricity from clean energy by 2030 including a doubling or even tripling of our in-state production from renewable sources. This brings with it the benefits of even more well-paying jobs, increased tax revenue and less vulnerability to the price spikes of fossil fuels from wars and political turmoil.

Vermont’s existing law governing renewable energy, the Renewable Energy Standard (RES), was written in 2015. This was a lifetime ago in terms of the climate crisis and what is necessary to solve it. The RES calls for Vermont utilities to get only 75% of their energy from renewables by 2032 with a meager 10% of that generated in-state.

But a new opportunity is upon us. President Biden and the U.S. Congress have kicked the door wide open for Vermont to re-establish itself as a climate leader by making renewable energy, weatherization of our homes and non-fossil fuel burning consumer goods so much more afford-

able. It’s now up to Governor Scott to agree to work with the Vermont legislature to take the important next step in 2023: committing Vermont to reaching a 100% renewable energy goal with much of this generated right here in Vermont. This action would revitalize the once thriving in-state clean industry jobs while ensuring we met our critical clean energy goals and importantly, make Vermont once again a leader in the fight against climate change.

Peter Sterling is the executive director of Renewable Energy Vermont (REV), the voice of Vermont’s renewable energy business community who are working to eliminate our reliance on dirty fossil fuels by increasing the use of renewable energy and building a clean energy economy. ♻️



REASONS TO NOT GET AN ELECTRIC VEHICLE?

Greg Whitchurch

Why does an electric vehicle (EV) get better mileage in summer than in winter? Why does an EV lose range when driving fast on the Interstates as compared to slower on two-lane highways? Why does an ICEV internal combustion engine vehicle (ICEV) get better mileage on the highway compared to city driving?

Let's try a simple thought experiment: Say your main vehicle was a ten-wheel dump truck. Would you expect that a trip downtown and back to buy a newspaper would take less fuel than the same trip to pick up a bag of concrete? Probably not noticeable, wouldn't you say? In fact, it does cost a significant amount more energy to move the concrete bag back home than to move the paper; but that extra amount of fuel for the concrete is dwarfed to insignificance by the massive amount of fuel required to just get the 12-ton vehicle there and back.

Similarly, an ICE car is about 24% efficient overall; an electric car is about 91%. So, given the comparatively small amount of energy used by the EV, increased energy needs for heavy loads, or fighting wind resistance at high speed, or even cold weather driving become noticeable and, since we've come to ignore ICEV energy wastefulness, it's irritating. Likewise, cell phone reception is horrible; but there are other considerations that have made them, over time, preferable to landlines for many of us.

ICEVs also suffer losses from wind resistance and colder weather, but they're hardly noticeable, even hidden, when compared to their overall wastefulness and horrendous stop and go and idling losses. ICEV engines run and pollute even when your car is stopped at a light, in traffic, and drive-throughs. This is not the case for EVs.

ICEVs carry a lot of extra weight and complexity, therefore, using and wasting a lot of energy to deal with excess heat, friction and noise. EVs use a little extra energy to heat and cool the cabin and have no noise suppression needs. During acceleration, ICEVs struggle and get very poor mileage. Acceleration affects EV energy use relatively little. ICEVs need transmissions because their operating efficiencies



The Whitchurches charge their Kia Niro electric vehicle during a long holiday trip. (Courtesy photo)

and abilities lie within a very small RPM range. EVs need no shifting transmission, because they can operate at full torque from one RPM up through 15,000 RPM.

ICEVs have about 2,300 moving parts in their drive trains. EVs have about 23. ICEVs need constant monitoring, maintenance, and replacement and repair of their drive train parts throughout their short lives. EVs commonly need no drivetrain maintenance beyond brake pads (and even those last longer than ICEV's). ICEVs need seasonal maintenance and preparation. EVs only need windshield washer antifreeze, winter wipers and tires.

Why are car manufacturers pushing ICEVs so hard right now? Why are dealerships so reluctant to show off (or be honest about) EVs? As Upton Sinclair said, "It's difficult to get a man to understand something when his salary depends on not understanding it." When an EV leaves a dealership, they know that it's not the oft-returning cash cow that an ICEV would be.

A variation of Sinclair's observation can also explain why fossil fuel companies and some ICEV owners' strain so hard to protect their own status

quo. If one doesn't want to face the unknowns of switching, then rationalizing with anti-EV myths helps: bit.ly/ct-uk-myths (see sidebar, too.)

It is a mistake to only apply the typical assessment and cost analysis strategies we developed during the ICEV years. For example, one would then be ignoring that ICEVs are far more dangerous as well as worse for everyone's health and the environment than EVs; or, one would be assuming that somehow all of the damage done by continuing to run ICEVs will somehow disappear when one finally does stop.

Buying a used EV is more like buying a used book than buying a used ICEV. Of course, you want to kick the tires, check out the appearance all around and

inside, but wondering about whether the engine oil was changed regularly, how much the engine or transmission was abused, how soon the exhaust system might need replacement – these considerations no longer apply. We've bought used LEAFs. Checking out the current health of the battery is quite easy; www.LeoSons.com in Lawrence, MA will do it for free!

In Vermont you can reduce the upfront cost of purchasing a new EV by as much as \$13,000 thanks to federal tax credits and local incentives. As recently stated by a local engineer on his town's listserv, "I'm driving a 2020 Chevy Bolt, and I love it. I have 40,000 miles on it without a hiccup. The federal tax credit and utility incen-

tives got it under \$25,000. It is a great car. Quick, smooth, quiet, steady, 260-mile range. I'll never go back to gas power. Now when I occasionally have to drive a gas car it feels like driving farm machinery." bit.ly/devt-compare

EVs cost more because they're worth so much more, to you! Review the past few years of your gas mobile's maintenance, repair, and fuel costs; then compare that to an EV's lack of maintenance and repair and low fuel costs, as well as its MUCH higher resale or trade-in value. Consider shifting some of that wallet-bleeding up front to the initial cost of the car. Use Efficiency Vermont's cost of ownership tool to see the long-term savings that can come with an electric car: bit.ly/devt-tco. Our own EVs have needed only tires, wipers, fluid and electrons over these past seven years.

For most people home charging compares to \$1.50 per gallon of gas. But you say you can't afford a Level 2 (L2) charger at home? We personally have owned EVs

Cont'd on p.5

GAS CAR VS HYBRID VS EV

1. According to data from the Nat'l Transportation Safety Board (bit.ly/kbb-fire): **Fires** per 100,000 cars: Gas 1,530; Hybrid 3,475; EV 25. **Gasmobiles caught fire 60 times as often and Hybrids caught fire 120 times as often as EVs!** (also: bit.ly/ct-gsuv-fire) Hybrids are NOT a "bridge" to EVs (except emotionally); they contain the worst of both worlds: see last 3 paragraphs of bit.ly/ct-phev-fake.

2. **Charging** is difficult: For just our family and the neighbors we know personally in Central VT, our EVs go to Quebec City, Ohio, Nova Scotia, Newfoundland, Montreal, Boston. Might you be willing to spend another 40 minutes at a service area every few hours on a long trip in order to halt your car's contributions to deaths and injuries of people and the environment?

3. **Mining** the raw materials and manufacturing EVs is detrimental to the environment and indigenous peoples: Absolutely. But FAR less than for gasmobiles. When fuel is also considered, the balance is tipped to vertical: see bit.ly/ct-ev-source. ♻️



See statistics in sidebar re: car fires. AdobeStock_67433/vladimir kondrachov



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Vermont's Opportunity to Ensure Accessible Electric Vehicles – for Consumers and Climate

Members of the Act on Climate Vermont Coalition

When it comes to getting where we all need to go – which often needs to be by car or truck in rural Vermont – the options for cleaner, more affordable vehicles are good. They are also about to get better with the advancement of two new, innovative programs.

Here's how. In the early 2000s, Vermont first adopted a set of rules requiring auto manufacturers to provide Vermonters with more efficient cars than federal standards required. Since then, this program, known as Advanced Clean Cars, has been a critical tool for manufacturer innovation, improved access to cleaner vehicles and emissions reductions. To meet climate commitments and the growing public demand for cleaner vehicles, two new programs are now available to deliver new requirements for zero-emission car sales – the Advanced Clean Cars II (ACCI) rule and an Advanced Clean Trucks rule (ACT) – and Vermont is poised to join both by December of this year.

Building on the success of the initial standard, ACCII would require auto manufacturers to meet stricter emissions requirements and to steadily increase the annual percentage of new electric vehicles (EVs) available for sale in Vermont, eventually reaching 100% of all new cars and light trucks sold by 2035. The Clean Trucks rule would similarly require auto manufacturers to sell an increasing percentage of zero-emission medium- and heavy-duty trucks between model years 2026 and 2035, though not attain a 100% compliance threshold.

These rules will set the conditions for Vermonters and Vermont businesses to gain access more clean, cost-effective vehicles – putting the onus on the manufacturers to deliver these options every year. ACCII and ACT won't require consumers or fleet owners to immediately transition to zero-emission vehicles, nor will anyone be

coming for your older gas- or diesel-powered vehicle. These programs will simply support and enforce a gradual market transition to allow for clean vehicles to become increasingly available over the next decade and beyond.

With gas prices yet again making it hard for Vermonters to make ends meet, more Vermonters are clamoring for more affordable, efficient and electric vehicles, and the rules are essential to meeting that growing demand. And, given that transportation in Vermont accounts for about 40% of the greenhouse gas emissions we collectively generate in this state, the rules are also fundamental to substantially reducing climate pollution and creating a more resilient, equitable and clean transportation system in our rural state.

We must continue to diversify Vermont's transportation sector through investments in options such as expanded public transit, ride sharing, and improved bike and pedestrian-friendly infrastructure to give Vermonters non-vehicular options to get where they need to go. At the same time, for people who must drive, these rules will ensure cleaner, more affordable electric vehicles are accessible to all who want them in the coming years. This program will help ensure that cleaner vehicles are available – and with an equity component embedded in the ACCII program design, there is an opportunity to deliver more clean vehicles to those who need them most.

In short, these programs will provide needed benefits to people's pocketbooks – and the planet. Recent research from the Union of Concerned Scientists found that the total lifetime emissions from an electric vehicle are 50% less than those from a comparable vehicle equipped with a gasoline or diesel engine, and that "driving the average EV in the United States produces global warming emissions equal to a gasoline vehicle that gets 91 miles per gallon." In Vermont, with an electric

grid cleaner than the national average, EVs will produce even greater benefits – and these EVs will only get cleaner to drive as we build out more renewable energy.

We also must ensure that these options are financially within reach for everyone. Drive Electric Vermont research shows that even though consumers may pay a bit more upfront for an EV, all told, EV owners can save roughly \$1,500 per year or more. But despite these overall savings, the initial cost of obtaining an EV can be a major barrier preventing the transition to using one, so it is essential that Vermont continues expanding incentives for EV purchasing and leasing. Fortunately, new programs in the state and a recent infusion of federal funds are prioritizing incentives to support lower income and historically overburdened Vermonters to access and afford this investment. Last year, the Legislature appropriated approximately \$20 million for statewide EV incentives.

Throughout September, the Vermont Agency of Natural Resources (ANR) hosted a series of six regional public engagement events around the state. Hundreds of Vermonters showed up in person or weighed in via the public comment portal to voice their support for the rules, ask questions and outline their concerns. The ANR is now in the process of reviewing that input and will be compiling answers to the questions they received and ad-

ressing the comments and concerns that were raised. The ANR is expected to deliver their summary document to the Legislative Committee on Administrative Rules (LCAR) by November 1, 2022, and it's expected that LCAR will be taking up the rules later in November.

These new rules are an essential and logical next step in Vermont's long-standing commitment to cleaner, more affordable vehicles and are imperative to meeting Vermont's legal obligation to help reduce planet-warming pollution. They will also help ensure that all Vermonters can access and benefit from cleaner cars and trucks, saving them money, reducing public health impacts and creating the transportation system of the future. It's exciting that Vermont is joining 17 other states and jurisdictions to advance these rules, and we look forward to working with Vermonters and Vermont policy makers to bring these rules across the finish line this December, so that Vermont can stay on track to deliver additional cleaner transportation options beginning with model year 2026.

Members of the Act on Climate Vermont Coalition include Johanna Miller of the Vermont Natural Resources Council, Lauren Hierl of Vermont Conservation Voters, Jordan Giaconia of Vermont Businesses for Social Responsibility, Chase Whiting of Conservation Law Foundation, Robb Kidd of Sierra Club's Vermont Chapter, and Ben Edgerly Walsh of Vermont Public Interest Research Group. ♻️

Reasons – Cont'd from p.4

for seven years – only EVs for three – and we charge from a regular 20A 120VAC wall socket with 16A Level 1 (L1) "trickle" chargers. Many EV owners all over the world have no at-home charging available, due to living in condos and apartments. They fuel up at work, while shopping, or at a station (like ICEVs). We almost never charge away from home, except on long trips. A 16A Level 1 charger will give you three to five mph (miles every hour); so overnight will supply 35 to 60 miles depending on temperatures and speed when driving.

However, L2 chargers are becoming easier to install and more flexible. For homes with small, low amperage main panels, there's the www.dcelectric.com/dcc-12/; for long or expensive-to-access sites there's the bit.ly/mtr-charger; for quickie "let's share the existing electric dryer socket" people there's the bit.ly/dryer-charger. These are just examples; contact your EV charger experts for more help.

You can, like us, also run your house off your EV for several days during a power outage then drive your EV somewhere where there's power for a recharge. A typical 65 kWh EV holds as much power as five 13 kWh Tesla PowerWalls, and is more

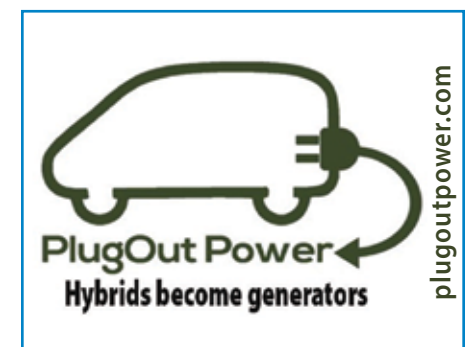
portable. Running a gas generator during an outage is like opening your fridge door to cool your house. The pollution only further aggravates the climate crisis while poisoning your air.

ICEVs as a class are already losing value fast. EVs lose so little value over time that Tesla and Ford aren't allowing lessors to buy out their EV leases any longer. The cars don't wear out like ICEVs do; the batteries last far longer than originally expected and can be repurposed, or fully and cheaply recycled (bit.ly/ct-eolb, bit.ly/ct-ev-batt). Right now, three-year-old Kia Niro EVs exactly like ours are listed at 90% to 105% of what we paid originally (bit.ly/ct-ev-tips3).

The point is EVs aren't just a stepwise improvement. It's more like moving from horses to cars. A hybrid would be like towing a horse and trailer behind your car in case you ran out of gas. EVs offer improved efficiency, safety, fuel, emissions, reliability, longevity, resale value and total costs. Oh yeah, range anxiety is a real thing! But we all get over it, some sooner than others.

The Whitchurches drive only EVs and use induction cooking in their Net Zero+ Middlesex, Vermont Passive House. For related articles: bit.ly/get-w-ev. ♻️

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Environmentally: Keep a Gas Car or Buy a Plug-In Car?

Wayne Michaud

Many factors come into play when evaluating the power source of the personal vehicle you choose to drive. Hold on to your internal combustion engine (ICE) vehicle that uses gasoline? Or make the big switch to a plug-in vehicle (PEV), such as a plug-in hybrid (PHEV) that uses little gasoline? Or an all-electric (EV) that uses no gasoline? In the August issue of Green Energy Times, we covered the financial aspects of this decision; in this issue, we address the environmental impact: emissions and energy.

On the surface, with PEVs emitting little or no CO₂ from the tailpipe, they would be the clear winners environmentally. But within this are factors and nuances that need to be explored.

The most significant factor is emissions over vehicle life cycle: from manufacture to end-of-life. A popular myth is that greenhouse gas (GHG) emissions are higher for EVs than ICE vehicles overall because of the battery. According to research by the U.S. DOE's Argonne National Laboratory, it's true that the emissions from extraction and processing of minerals for EV batteries, their manufacture, and other manufacturing and end-of-life are three to four times higher for EVs. (Let's not overlook the entrenched negative environmental impact of an ICE vehicle's power source: oil. Oil pollutes from extraction to emissions.) But because they have zero tailpipe emissions through their life, researchers in a Ford Motor Company and University of Michigan study point out that light-duty EVs "have approximately 64% lower cradle-to-grave life-cycle greenhouse gas emissions than ICE vehicles on average across the United States." PHEVs do have some tailpipe GHG emissions, but over their lifetimes these are still significantly lower than ICE vehicles.

As PEVs continue to proliferate, what will happen to their batteries that degrade over time or are at end-of-life? While challenges currently exist in recycling these batteries which are made up of different components, there is good news. A growing network of recycling companies, in partnership with automakers, are setting up not only to recycle battery parts, but manufacture battery components from recovered lithium-ion batteries. These batteries will also have second lives, such as for grid-scale storage systems at solar farms and for stationary storage in homes.

To reinforce the GHG emissions and energy impact through vehicle operating life, here's a couple of fueleconomy.gov comparisons. Say you own a ten-year-old RAM pickup and would think about switching to a new Chevy Bolt (which would not be a bad deal considering the price recently dropped \$6,000, federal credits and state incentives are available, and it has half the maintenance costs of ICE vehicles). Energy-wise, the 4.7-liter, eight-cylinder RAM, based on 12,000 miles of driving annually, burns 14.9 barrels of oil on regular gas, while the Bolt burns the equivalent of 0.1 in electricity. For GHG emissions in grams per mile, the RAM comes in at 562 while the Bolt emits zero grams. If your ICE vehicle is a late model economy car like a 2017 Nissan



Sentra 1.8-liter, four-cylinder, 7.4 barrels of oil are burned annually and GHG emissions grams is 278. While PHEV comparison scores are not available, we can estimate these models will have one-half or less the emissions and energy impact.

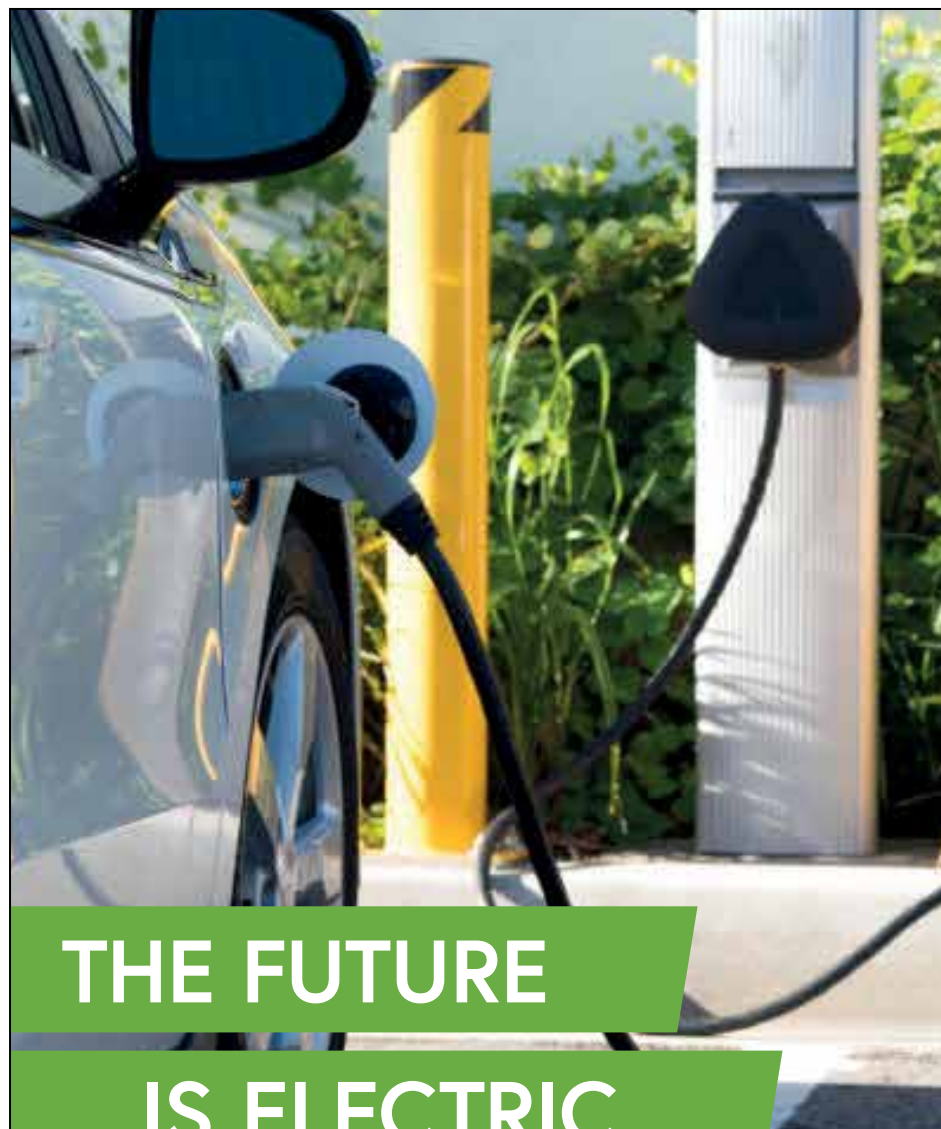
Another important emissions and energy factor to consider is efficiency. A Yale Climate Connections analysis explains how EVs are far more efficient than ICE vehicles, which are only about 1/5th efficient. Only 20% of their fuel goes toward moving the vehicle forward with the rest expended in heat and friction. On the other hand, EVs get their energy from electricity which directly powers the drivetrain, making them 4/5ths efficient. The benefit of this efficiency is manifested not only in fuel savings, but environmentally as well, with the transition away from oil and resulting reductions in carbon emissions and pollution.

In conclusion, keeping your ICE vehicle or switching to a new PEV for environmental reasons depends on factors that include the emissions and energy impact based on vehicle size and age; number of miles driven, and for PEVs, the source(s) it gets its electricity from. Essentially, it all boils down to the number of miles driven for a PEV to get to a break-even point to make up the emissions and energy expended by an ICE vehicle. This can vary widely according to all the factors involved. In a Reuter's analysis based on an Argonne study of when EVs become cleaner than gasoline cars, a best case scenario would be less than 10,000 miles to a worst case of nearly 80,000 miles. So, while there are some complexities involved, switching to a PEV is better for the environment.

Wayne Michaud is Executive Director of Green Driving America Inc., a non-profit that advocates for and educates on transportation efficiency and cleaner transportation. The organization is based in California with a branch location in Vermont. Michaud headed Idle-Free VT in Vermont from 2006-2016. ♻️

WHAT ABOUT THE HEALTH IMPACT?

When comparing emissions of PEVs versus ICE vehicles, it is always about CO₂ and GHGs. What is overlooked are tailpipe toxins and their impact on human health. We're talking about emissions like benzene, carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter that come from the tailpipes of light- to heavy-duty ICE vehicles. While today's modern vehicles are cleaner than those of decades ago, their emissions can still exacerbate or even cause respiratory illnesses like asthma, and continuous exposure can lead to heart disease, lung cancer, and even premature death. EVs have no tailpipes and emit no chemical toxins, leading to improved air quality and health, and reduced health care costs. ♻️



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After the Storm



Sara Gutterman

Hurricane Ian's trifecta of wind, rain, and storm surge wiped out communities and caused unimaginable destruction. In the aftermath of the superstorm, victims will reconstruct their lives. But should they rebuild their homes?

Hurricane Ian rendered us speechless. With heavy hearts, we all send thoughts, prayers, and donations to our friends and colleagues in Florida, hoping that our support will, in some small way, ease their inconceivable suffering.

Nothing can be written or said to assuage the pain that the superstorm—one of the worst weather events in U.S. history—has inflicted, resulting in somewhere between \$30 to \$60 billion in damages.

While it's impossible to undo the damage, perhaps we can glean some hard-learned lessons so that we are better prepared for similar events in the future—downscaling them from catastrophes to occurrences.

Hurricanes are an indisputable weather reality, and the link between superstorms and climate change is complex. Science shows that above-average sea-surface temperatures in the Atlantic and Gulf of Mexico are causing more frequent and intense storms and that these warmer waters are augmenting the energy and moisture levels of hurricanes.

As the atmosphere heats up, more water vapor is retained in the air, causing a higher frequency of extreme precipitation. The eastern part of the country is becoming all too familiar with this scenario—the region is experiencing 40% more precipitation today than 60 years ago.

Additionally, rising sea levels are strengthening storm surges and preventing floodwater from draining effectively. In fact, storm surges during hurricanes are often several feet higher than they were decades ago due to climate change, resulting in far more flooding and destruction.

Given that category 4 and 5 hurricanes are occurring more frequently, it would make sense to plan accordingly.

Unfortunately, Florida's population explosion over the past two decades has resulted in unchecked urban sprawl with rambling swaths of impermeable surfaces, making the entire state, and especially coastal areas, exceptionally vulnerable to catastrophic flooding during superstorms.

Developer-friendly laws, risky dredge-and-fill development practices, and a decisive lack of regulation and enforcement has kept home prices low and demand high. But, in the process, developers have paved over crucial swamps, shoals,

mangroves, and wetlands that were once able to absorb excess floodwater during storms.

Now, floodwater is channeled into artificial canals, waterways, and basins. While this has created high-priced faux waterfront property, this man-made infrastructure has proven to be an inadequate replacement for crucial flood-absorbing ecosystems, leaving most existing homes woefully unprepared when facing a superstorm.

Endemic Problem

According to Green Builder Media's Resilient Housing Design Guide, resilient homes utilize durable building envelope materials, like insulated concrete forms (ICFs) or structural insulated panels (SIPs) and have features like tie-down or anchor systems, inlets, pilings, structural bracing, raised foundations, backup energy systems, and access to fresh, potable water in an emergency. But only a very small percentage of homes in the U.S. actually boast these features.

To make matters worse, in some areas of the country, unsustainable land use strategies and myopic planning decisions have allowed development in flood-prone areas, enabling extreme weather events

to quickly turn from annoyances into disasters.

The status quo of policies and practices that permit irresponsible building—and rebuilding—in high-risk areas, as advocated by the development and building industry, is ultimately impoverishing homeowners, communities, and municipalities throughout the nation, threatening to bankrupt the very programs that have been implemented to provide protection.

"If the risk from wildfires, flooding, storms, or hail is increasing, then the only sustainable option we have is to adjust our risk prices accordingly," admits Ernst Rauch, reinsurance firm Munich Re's chief climatologist. "Affordability is so critical [because] some people on low and average incomes in some regions will no longer be able to buy insurance," he asserts.

According to Green Builder Media's Editor-in-Chief Matt Power, "It's no longer prudent to put an optimistic spin on the scenarios that lie ahead. Population growth, combined with unsustainable behavior by both industry and individuals make a sudden reversal of greenhouse gas pollution extremely unlikely, if not unthinkable. Since we can't compel our neighbors to change their behavior, what's left? Preparation. We can build disaster-resistant housing."

The Unthinkable Decision

Community members across the nation are being forced to make difficult choices about whether or not to rebuild after

Renewables Survive Hurricane Ian – Cont'd from p.1



Homes at Babcock Ranch. Photo via Babcock Ranch.

needed at night. The first array, of 74.5 megawatts (MW), was installed in 2016, and since then a second of the same size has also been built (<https://bit.ly/3eikSB>). Babcock Ranch laid claim to being the first community in the United States powered entirely by the sun.

In 2018, FPL inaugurated a battery storage system, which, at that time, was the biggest in the country. By the standards of today, four years later, the capacity of the system seems to be almost trivial, at 10 MW. It was, however, sufficient to the needs of the community, in an emergency, and it would help supply the grid with stable power. It was set up to detach from the rest of the grid in an emergency, so BR can operate as a microgrid, on a stand-alone basis. (<https://bit.ly/3rJLHO>).

Hurricane Ian made landfall at about 3:00p.m. on Wednesday near Fort Myers, Florida. The eye of the storm was nearly 35 miles across, and hurricane-force winds extended 15 to 25 miles beyond the eye wall. After landfall, Ian continued to make its way to the northeast.

Babcock Ranch is about 25 miles northeast of Fort Myers. At the time Ian's eye came ashore, BR may already have been experiencing hurricane-force winds, but the winds were sure to get stronger as the wall of the eye moved closer. BR, however, beat the hurricane. Its solar power and batteries gave it the ability to keep going while every other community was blacked out.

By the time Ian left Florida, over 2 million people had lost power. Unlike BR, those other communities were dependent on baseload plants, which operate at some distance from customers, supplying them through vulnerable power lines. Whether it happens because of damage at the plant, or because of cut power lines, when a baseload plant fails, it has to shut down. It cannot keep going because the power it generates has to go

somewhere. Also, baseload power plants are inflexible and require other kinds of power plants to follow demand. If they fail, the baseload plants they support may have to shut down. Bear in mind that the baseload paradigm was developed a hundred years ago.

By contrast, solar power is easy to control, so it can be cut off if there is no load for it to supply. Batteries can be controlled to provide for demand rather precisely. Together, they are very flexible, and the power adjustment can happen automatically, using computer controls. Solar plus batteries can adjust to changes in load demand instantly, where the old baseload system took several minutes at least. That gives solar plus batteries an important advantage over the old baseload system. They can match demand quite well.

Looking at resiliency, however, we can see that a microgrid, powered by solar plus batteries, can be set up to keep going even when the grid fails. This is done by isolating it from the rest of the grid. For this, the system needs to be able to withstand whatever weather will hit it, so the electric lines were buried.

Some people who were at Babcock Ranch during Hurricane Ian have said that they were frightened by the storm. That is not surprising, because Ian was a major hurricane, and it hit them head-on. One thing that we know is that the solar array and the batteries suffered a small enough amount of damage that they just went on working.

Designed to be resilient, BR also has had no interruption to its water supply or internet. It is the only community in Southwest Florida where these systems have continued to operate, according to reports.

⁺ Actually hurricane Ian came in at just 5 mph winds shy of a Cat 5 storm when it made landfall. ☻

the assault of a flood, fire, or superstorm. Many of them opt to rebuild, resolute in their decision to not abandon the places where they grew up and raised families—the places they love the most.

But how many catastrophic events does it take to compel a community to reach the heartbreaking verdict that remaining in place is no longer worth the suffering that comes with each ensuing natural disaster? Where is the breaking point?

It's sobering to recognize that, at some point, this profound decision may be taken out of the hands of community members, as local, state, and even federal governments intervene to prevent rebuilding in disaster zones.

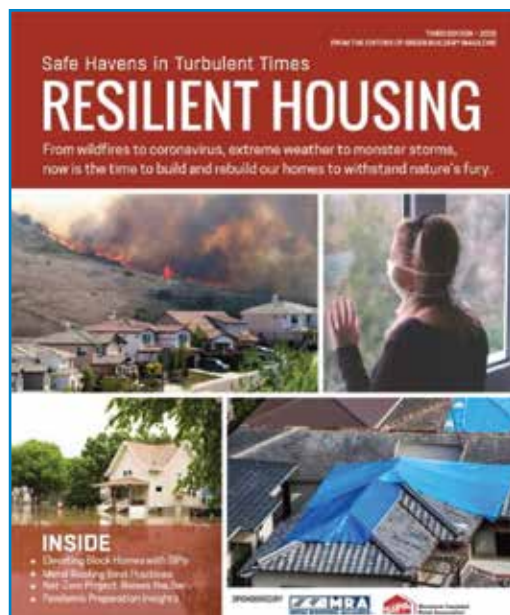
But these types of initiatives are simply a drop in the bucket relative to what is needed, and despite the widespread destruction, it's likely that not much will change.

Which brings us to the inevitable question: if there isn't enough money to protect and rebuild every community impacted by climate change, which ones get salvaged and which are abandoned? Who makes the ultimate decisions, and how will those decisions be made?

The floodgate is opening, bringing with it a surge of unavoidable questions and uncomfortable decisions. In the end, which communities are valuable enough to protect?

Sara Gutterman is cofounder and CEO of Green Builder Media.

Reprinted with permission, courtesy of Green Builder Media (greenbuildermedia.com). The original blog can be found at https://bit.ly/GreenBuilderMedia_After-theStorm. ☻



To learn more about how you can prepare your home for the impending floods, download Green Builder Media's free e-book, *Resilient Housing Design Guide*

Acorn Energy Co-op's Fourth Community Solar Project is Moving Forward

Mary Mester

Fundraising for an innovative local community-owned solar project in Hinesburg, Vermont under development by the Acorn Renewable Energy Co-op of Middlebury, VT is moving forward. The proposed project, Acorn Energy Solar 4 (AES4), will be a 150-kW solar array on the capped former municipal landfill located at 179 Observatory Road in Hinesburg.

On July 20, 2022, the final review of the Vermont Equity Crowdfunding documentation for AES4 was completed by the State for the public offering of shares in the project. This review allows Acorn Energy Co-op to begin marketing shares in the project to Vermont residents, businesses, and non-profit organizations with an electric meter in the Vermont Electric Cooperative (VEC) service territory. These investors will receive the project's net metered credits on their VEC bills, and ultimately take ownership of the project.

"Because we have developed this project in connection with the host community, we have been able to combine local investment, ownership, and management of a solar array in a manner that makes the most of a brownfields redevelopment opportunity," said Acorn Energy Co-op President Benjamin Marks. "We hope that the installed price per Watt of the array will also be attractive for prospective participants."

The Hinesburg landfill is ideal for solar development since it has good solar exposure to the south. In addition, this type of brownfield site receives favorable treatment from Vermont's energy permitting and approval agencies. Acorn Energy Co-op applied for a Certificate of Public Good for the project from the Public Utility Commission which was issued by the Commission on July 6, 2021.

Acorn Energy Co-op, and Aegis Renewable Energy of Waitsfield, VT (Acorn Energy's contractor), have developed the plan for the approximately \$602,545 Hinesburg project. The project's design calls for 360 solar panels, 540 watts each, which will cover a little over one acre of the capped Hinesburg landfill site.

The Acorn Energy Co-op's innovative investment model calls for two initial categories of investors in AES4: a single Series A Member and multiple Series B Members. Union Mutual Insurance Company of Montpelier will be the Series A investor.



Acorn Energy Co-op's second Community-Owned Solar project was commissioned in March 2020. This is a 150-kW solar array in Shoreham, VT. Consisting of 612, 340-Watt solar panels, the group net metered project generates about 249,000 kW annually, enough electricity to power 30 to 40 homes. (Steve Maier, secretary of Acorn Energy Co-op)

The Series A investor will provide approximately 29% of the capital to construct the project and in return will receive federal tax credits for their project participation. Their involvement helps to keep the costs down for the Series B investors.

The remaining equity funding will come from the Series B investors (Vermont residents, businesses, churches, and organizations with an electric meter in the VEC service territory) from Hinesburg and surrounding communities, who will be project participants. These investors will receive net metering

dollar credits applied each month to their VEC electric bills based on the amount of electricity produced the previous month for the number of investment units they have purchased.

"We are extremely pleased to have Union Mutual Insurance Company as a major participant in our Hinesburg solar project," said Richard Carpenter, Acorn Energy Co-op's treasurer. "Their support has been invaluable in bringing true community-owned solar to the VEC service territory."

Six years after the Hinesburg project begins electricity production, the equity structure will "flip" and the individual investors may take full ownership of the project, making AES4 one of a small number of truly local, community-owned

net-metered solar projects in the state.

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

A schedule of informational online meetings for prospective investors can be

found at: acornenergycoop.com.

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

For more information on the Hinesburg solar project, or to join the Acorn Energy Co-op, visit acornenergycoop.com, email info@acornenergycoop.com, or call Mary Mester at 802-385-1911.

Mary Mester is the Acorn Renewable Energy Co-op Coordinator. ♻️

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The Acorn Energy Co-op is now offering shares in a new Community Solar project in Hinesburg, Vermont.

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MEET YOUR SOLAR INSTALLERS GRASSROOTS SOLAR, MANCHESTER CENTER, VT

George Harvey



Bill Laberge, CEO of Grassroots Solar, got his practical introduction to solar power in 2013, when he had a 9.5-kilowatt (kW) system installed at his home. He bought an electric vehicle (EV) and was soon providing it with electricity from his own solar panels.

In those days, Laberge made his living as a fine woodworker. His new solar system and EV became central issues in his life. Once he had seen the benefits of a pollution-free lifestyle, he wanted to share that with everyone else. He became a solar installer. That was only a beginning, however. He had a vision. It was built around some very appealing ideas. They ranged from saving money on energy at home to saving the planet for his grandchildren. The ideas included safety, sustainability, and resilience. But that vision included something that a lot of solar installers did not know much about at that time, which was batteries. He knew we need batteries to be free of fossil fuels.

His employer did not quite share that vision, so he started his own company in Dorset, Vermont, specializing on battery backup systems and off-grid systems. That company is Grassroots Solar. Backup battery systems are very powerful tools for dealing with climate change.

They benefit not only their owner and the other residents of the building where they are installed, but everyone else also. They can help regulate the power grid, keeping costs down for everyone. They can provide electricity in times of high demand. They can absorb the extra energy at times when demand is lower than supply.

Laberge told us, "Grassroots Solar focuses on helping people to electrify their lives." Many people see that kind of change as something that is coming, as though it were in some sort of mythical future world. Laberge, however, seems to take a fair amount of pride in being able to show them that time has already come. "The best time to install solar was yesterday," he said, "but today is pretty good, too."

Grassroots Solar was built up on expertise. Laberge is quite proud of the fact that his expertise began as a customer, because it helps him see everything from a customer's point of view. But he is also NABCEP-certified as a solar installer. He is not the only person with that level of certification at Grassroots, as **Danielle Laberge**, the sales manager, is a NABCEP-Certified PV



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Bill Laberge has been able to build up a list of suppliers that is very impressive. This is especially important

today, because the whole world is in the throes of supply issues so having several vendors for solar panels, batteries, and inverters makes it possible to move ahead on projects that might otherwise be delayed. Please bear in mind, however, that the multiple choices are all carefully chosen, first-rate products. Grassroots is the exclusive dealer for SunPower in Vermont and the SunPower Equinox®

system, which are the most efficient panels on the market, according to Grassroots' web site. Beyond that, there are several other companies whose products may be important for a project, including Sol-Ark, Fortress Power, SimpliPhi, SolarEdge, and sonnen.

The nature of solar systems for households and small businesses is changing as technology changes, and the products Grassroots Solar provides are chosen for this. In some cases, solar panels, inverters, batteries, and controllers communicate with each other to provide the best performance possible. They also can communicate with the owner of the system by using the internet.

There is an aspect to Bill Laberge and



Winner of Vermont's Greenest Building Award (category Net Positive), Grassroots Solar is proud to be the solar installer and a part of the team that created this award-winning solar installation in Manchester, VT. (Photo credit Bill Laberge)

Grassroots Solar that we really should not let go unmentioned. It is a clear desire to help others. After Hurricane Maria, Laberge went to Puerto Rico to help build up solar-powered microgrids. In that effort, he worked with products and people of the German company, sonnenBatterie. Laberge was rewarded in that experience by more than good feelings. He also got recognition from sonnen, when the company gave him its 2018 Brilliance Award. Laberge is clear about wanting to educate those people who do not yet understand about solar power. His message to them is about benefits: "You get a big bonus." And that bonus is not merely financial. Grassroots Solar's website is grassrootssolar.com. ☼

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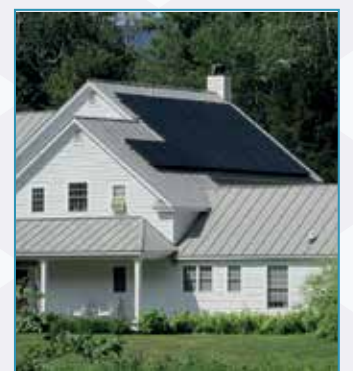
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BATTERY SYSTEMS HELPING OFF-GRID SOLAR INSTALLATIONS

George Harvey

Without doubt, there are still some among us who think of off-grid living, with solar electricity, in terms of very small and very primitive systems. Off-grid has been, and still can be, built of the simplest equipment imaginable, and some people prefer that way of living.

Surprisingly, however, an off-grid system may not only support a sophisticated lifestyle, but might even do it so well that we are unaware of any inconvenience, regardless of the demands we put on it. It is a situation that really is improving rapidly, because of great, new technology.

Chris Sparadeo, the off-grid division manager of Catamount Solar, recently gave us a run-down of how new, improved battery communication technology is opening new opportunities for off-grid living.

To explain this, let's take a look at a concept associated with smart grids. Demand response is a tool that a utility and its customers can partner on to keep costs down for everyone, whether they participate in demand response or not.

The times when demand is highest and supply is lowest are predictably those when electricity is sold for the highest price on the market. As a separate issue, and not so obviously, a utility's transmission costs are determined by the peak demand over a period of time. So, the costs associated with peak demand are reflected in all prices for electricity, regardless of when they occur. It doesn't take a lot of thought to see that reducing the peak demand can reduce the cost of electricity.



The system's Fortress Power 37 kWh battery bank and Sol-Ark inverter allows this southern Vermont home to make the most of the solar power it harnesses. (Courtesy photos: Catamount Solar)

One way to reduce peak demand is to defer certain kinds of electricity use until a time when demand is down. In order to do this seamlessly, there must be some communication between the utility and the participating households. The utility must be able to tell the household controller when demand is high, so the controller can decide what heavy loads to defer until later.

For example, charging an electric

vehicle (EV), operating a clothes dryer, heating up a tank of water, and running a heat pump to keep the house warm are all operations that can be deferred to some extent. The amount and the circumstances of deferral are things that can be programmed by the consumer. If the system is properly set up, putting off electric use will possibly not be noticed at all. But it can reduce the electricity bill.

Now comes the truly interesting part for people who live off-grid. Demand response is no longer something that is set up to happen by the utility and the customer, acting together. The high-tech solution of today makes this possible, even to those who live off-grid, through something called smart load management.

A smart reader might ask what the point is. After all, there is no utility bill to save money on. That is true. But the system has another advantage. It gives

the entire solar photovoltaic (PV) system new abilities to control the use of heavier loads, and in doing so makes the entire system more valuable.

The very simple solution to running an off-grid system is to charge the battery whenever possible and supply electricity to various loads as they call for it. But in a smart off-grid system, supplying electricity to the water heater is best done when the sun is shining, providing that the bat-



Dual pole mounted solar arrays and a beautiful Central Vermont backdrop. The mini split heat pumps in this home keep this array hard at work.

about charging and discharging the battery. Because the inverter is operating with a very precise understanding of the battery's state of charge, it can turn larger loads off and on via its dedicated smart loads circuit breaker.

When the inverter finds that the battery is fully charged while the solar PVs are still producing electricity, it does not throw the excess away. Instead, it will put that electricity into work that is useful. It can send electricity to the water heater, which can store energy as heat. It can send it to the EV, to charge that battery. It could use the excess electricity to run a heat

pump or a de-humidifier, or any of a number of other high-demand pieces of equipment.

Chris Sparadeo gave us a good understanding of how this can work, using the example of actual equipment in operating systems for smart load management. These two systems have solar PV capacities of 9,600 watts. They use Sol-Ark 15K inverters and have paralleled Fortress Power eVault Max 18.5 kilowatt-hour battery systems.

These systems operate in closed loop. That means that the Sol-Ark inverter and the Fortress Power battery communicate directly with one another and allow the inverter to make important decisions

about charging and discharging the battery.

There are two important effects of this we might note. One is that the entire off-grid electric system is operating much more efficiently and precisely than it would without closed-loop communication. The second is that the system can operate heavier loads than had previously been possible due to smart load management technology. Advancements in off-grid system technology are allowing people to embrace the new age of electrification and help gain major energy independence in their homes. ☺





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New Solar Array Generates Green Energy, Benefiting Community

Norwich Solar, Kinney Drugs Stores Announce New Solar Power Generation in Fairlee VT

Norwich Solar celebrated completion of its 45th community solar installation earlier this summer in Fairlee, Vermont. The 500kW AC ground mount system will provide Kinney Drugs with solar net-metering credits. The array is located in Green Mountain Power territory. The new solar array is tucked behind the Fairlee Drive-In Theater and is not visible from Route 5. The site was a marginal hayfield that was difficult for farming equipment to get to. Norwich Solar improved road access to construct the array and provided the landowner with ample acreage for haying.

Jim Merriam, CEO of Norwich Solar said, "This project adds locally produced renewable energy to Vermont and is a positive investment in the community's efforts to confront climate change." He added, "Installations such as these strengthen our local business, communities and landowners alike."

Norwich Solar signed a 25-year lease agreement with property owners that were looking for a way to integrate renewable energy into their long-term land use plans. The family has solar panels on their home already and welcomed the opportunity to offer their property for larger-scale solar because of the benefits of renewable energy for the planet. It also aligns with their plans to raise livestock and can use the fenced solar array for



Power Management Company (PMC), KPH's trusted energy advisor of Rochester, NY, helped facilitate the arrangement between KPH and Norwich Solar. PMC has helped KPH implement strategic energy initiatives from negotiating competitive energy supply agreements to portfolio-wide efficient lighting upgrades for nearly 20 years. Norwich Solar designed and developed the 500kW



The solar field in Fairlee, VT, estimated to produce about 1,000,000kWh per year, was leased to Kinney Drug Stores. To the right is the October 2022 Ribbon cutting; left is Michael J. Burgess, VP of Financial Planning, Kinney Drugs. (Photos: Nancy Rae Mallory).

pasturing the lambs, which further utilizes the land while keeping the grass down around the panels.

"After purchasing our property in 2014 our goal was to return 25 acres of field into usable land," explained the property owner (who wishes to remain anonymous). "We had 10 acres of new growth pasture pine and after several years, we reclaimed approximately six acres as hay fields. This left a parcel that was still in need of finishing. Working with Norwich Solar allowed us to finish our goal of utilizing the last 4 acres of land. This project, in addition to solar panels on our home, allowed us to further our green energy goals."

The solar field is estimated to produce about 1,000,000kWh per year which is enough to power 138 homes for a full year. In terms of carbon emission reduction, the four-acre Fairlee array reduces 781 tons of CO2 annually; roughly the equivalent of carbon sequestered by 839 acres of forest for a full year.

As the sole customer of the site, Kinney

Drugs (a subsidiary of KPH Healthcare Services) will receive credit for nearly 100% of the energy produced by the array. The company is a well-recognized regional business with 22 drug stores operating in Vermont and has more than 100 locations in total. As an employee-owned company, they focus on delivering quality care and cost savings to their customers. By purchasing solar power through community-scale net metering, Kinney Drugs is making sound business investments that reduce their energy costs and support ecological benefits that reduce carbon emissions.

"We are thrilled to partner with Norwich as the sole off taker of the solar project in Fairlee, VT," stated Mike Burgess KPH's Vice President of Financial Planning and Treasury. "KPH is committed to do our part in supporting the development of local renewable energy within our community and help to preserve the environment for generations to come. This is the second significant solar strategy we have implemented in recent years."



AC solar array in Fairlee, VT with support from Mascoma Bank and will own and operate the array. It was easy for Kinney Drugs to sign up and start accessing the benefits of net-metered solar power at no cost. By combining solar energy with other energy-saving initiatives, Kinney Drugs can reduce their energy costs by up to 30%.

"It was a great experience getting to know and work with the entire Norwich Solar team from start to finish," said Michael Hedges, PMC's Vice President of Sales. "This type of Community Solar transaction allows KPH to foster development of local renewable energy, while keeping their rooftops free of solar panels. We commend Mike Burgess and his team at KPH as they continue to be a leader in the marketplace." ♻️

Solar Investment Tax Credit: What Changed?

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy

President Biden signed the Inflation Reduction Act into law on Tuesday, August 16, 2022. One of the many things this act accomplishes is the expansion of the Federal Tax Credit for Solar Photovoltaics, also known as the Investment Tax Credit (ITC). This credit can be claimed on federal income taxes for a percentage of the cost of a solar photovoltaic (PV) system.

Let's take a look at the biggest changes and what they mean for Americans who install PV solar:

- The ITC increased in amount and its timeline has been extended. Those who install a PV system between 2022 and 2032 will receive a 30% tax credit. That will decrease to 26% for systems installed in 2033, and to 22% for systems installed in 2034. If you've already installed a system in 2022, your tax credit has increased from 22% to 30% if you haven't already claimed it.

- The solar plus storage equipment expenses included in the ITC have expanded. Now, energy storage devices that have a capacity rating of three kilowatt hours or greater are included. This includes stand-alone storage, but here's why you should pair it with solar.

The ITC will cut the cost of installing rooftop solar for a home by 30%, or more than \$7,500 for an average system. By helping Americans get solar on their roofs, these tax credits will help millions more families unlock an additional average savings of \$9,000 on their electricity bills over the life of the system.

Check out the Homeowner's Guide to the Federal Tax Credit for Solar Photovoltaics (<https://bit.ly/3Ldcr7M>) for more information on the ITC including eligibility requirements and how to claim it on your taxes.

Source: <https://www.energy.gov/eere/solar-tax-credit-changes> ♻️



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RENEWABLES AND ENERGY STORAGE HAVE ARRIVED

OFFERING CONSUMERS SIGNIFICANT SAVINGS

Jonathan Dowds

We all know that renewable energy is the future. But recently something interesting happened: the future arrived.

It's not all the way here – we are still getting far too much energy from oil, gas, and even coal – but it is here. Wind, solar, and energy storage are no longer novelties that operate on the periphery of a creaky, 20th-century power system. Instead, all summer, they have been stabilizing the grid, meeting peak demand, and driving down costs for consumers.

Sustained summer heat is brutal for the grid. Air conditioner use spikes and demand spikes with it. In New England, peaks in summer demand are more than 20% higher than the peaks seen on our coldest winter days. At the same time, high temperatures make power plants, transmission lines, and distribution infrastructure less efficient and energy losses increase. As the climate warms, longer, hotter, and more frequent heat waves are a recipe for disaster; this is why grid operators across the country were preparing the public for the possibility of rolling brownouts and other power supply disruptions during heat waves this summer. Fortunately, we have avoided major power disruptions and renewable energy is a big part of the reason why.

The New England grid operator, ISO-NE, reports that solar energy was instrumental in meeting demand during this July's prolonged heat wave. On its own, behind-the-meter solar, the solar electricity that is used on-site in real time without ever traveling across the grid, reduced peak demand by close to 4,000 MW – more than 15% of the total demand! – day, after day, after day from July 19th to 24th. This meant that instead of facing the demand levels predicted for high heat events, the ISO only saw demand associated with more typical summer weather, resulting in significant savings for consumers.

All this behind-the-meter solar obviously benefited the homeowners and businesses that were able to run their lights and air conditioners with zero-cost electricity, but it also benefited every ratepayer in New England. During peak periods electricity



3D rendering of renewable energy power plants - photovoltaics, wind turbine farm and battery container. (AdobeStock_248626760/malp)

is generated by the most expensive – and dirtiest – power plants on the grid and costs for utilities, and their customers, jump. By keeping these plants on the sidelines, behind-the-meter solar helps keep rates down for everyone. And there are other benefits as well. Because behind-the-meter solar doesn't have to travel across overheating distribution infrastructure that is losing efficiency in the heat and doesn't congest already strained transmission systems, it helps alleviate the need for a host of infrastructure upgrades. A previous analysis by Synergy Energy Economics – sponsored by Renewable Energy Vermont, Vote Solar, and Clean Energy NH – found that when considering the grid, health, and environmental benefits of behind-the-meter solar comprehensively, it has saved New Englanders more than \$180 million each year from 2014-2019. Since solar capacity has continued to grow and natural gas prices are surging, the saving this year will undoubtedly be even higher.

Simultaneously, cheaper, more effective batteries are providing similar benefits later in the day when the demand for power from the utilities is highest. (While electricity usage peaked at midday during the heat wave, behind-the-meter solar meant that the peak demand for electricity provided by utilities didn't occur until early evening). Green Mountain Power has been an early innovator with battery storage


and Vermonters are reaping the benefits of these innovations. During July's heat wave, GMP reported that by utilizing batteries in customers' homes and at their own solar facilities, the utility was able to save \$1.2 million in electricity purchases from expensive – and environmentally harmful – peaking power plants.

Finally, load management (changes in when we use electricity) is also helping utilities manage the challenges posed by extreme heat and high electricity demand. Frequently, we have at least some flexibility about when we run many of our largest electricity drawing appliances. By altering when in the day we are using these devices, such as by running air conditioning earlier in the day before the peak demand to "pre-cool" our homes or by program-

ming dishwashers to run or electric vehicles to charge later in the evening, we can lessen the strain on the grid with minimal disruption to our own convenience and comfort. Burlington Electric Department has been and leader in load management and through its "Defeat the Peak" program it encourages customers to change their energy usage patterns by donating a portion of the avoided electricity purchase costs that the program achieves to local charities. In July, this collaboration between BED and its customers resulted in a peak demand reduction equivalent to taking 445 homes off the grid. Increasingly, we will all be able to opt-in to automatic load management options that subtly and seamlessly tweak when some of our large devices are using power without even thinking about it.


This is the future, these are the pieces of the puzzle: renewable energy, energy storage, and load management. With the passage of the Inflation Reduction Act, we are primed for big investments in renewable energy and related technologies. Studies estimate that these investments will save the average household \$200 a year in lower energy bills and help cut greenhouse gas emissions by 40%. We are seeing the benefits now and they will only continue to grow as we increase our investments in these technologies and the future fully arrives.

Jonathan Dowds, Deputy Director Renewable Energy Vermont (REV). Learn more at revermont.org.



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MAINE SOLAR SOLUTIONS PARTNERS WITH HABITAT FOR HUMANITY

Introduced by George Harvey

In the pages of *Green Energy Times*, we have mentioned before that Sam Zuckerman and his company, Maine Solar Solutions, are always up to something interesting. An article of October, 2021, "So, What's Up at Maine Solar Solutions This Summer?" begins by saying precisely that. It goes on to describe the success of a large solar installation at Replenova Farm, which is certified organic by the Maine Organic Farms and Gardens Association.

Looking back on that article, one thing is striking. Replenova Farm is not just saving money with solar power, and it is not just looking to be able to tell customers it is doing something to save the planet. It says, "The farm also donates vegetables to the Good Shepherd Food Bank."

It is, perhaps, indicative of the quality of those who work to transform the world to renewable energy and away from polluting energy sources. Many people in the green movement are interested in giving others a helping hand.

Here, we have another example of that, a little news item that arrived from Kennebunkport, ME explaining more about the exciting work Sam Zuckerman is doing. It is not an impressively large installation, but we might expect that it will make an impressive difference in the lives of people in one family in particular:

Cape Porpoise home with solar panels is the first done for Habitat for York County

Maine Solar Solutions has partnered with Habitat for Humanity York County



Sam Zuckerman (left), owner of Maine Solar Solutions with Gaberiel, Alicia and Derek Harmon along with Amy Nucci, executive director of Habitat for Humanity. (Emily Ferrick, The Climate Initiative)

to provide solar panels for a home in Cape Porpoise, a community within Kennebunkport. The new house was outfitted with more than a dozen solar panels. The panels and installation were donated by Maine Solar Solutions of Freeport.

"We are celebrating ten years at Maine Solar Solutions, and we wanted to give back to the community in a big way," said Maine Solar Solutions owner Sam Zuckerman. "This partnership will allow us to not only give back, but also to make a long-term difference with energy savings, energy independence, and clean energy.

We are proud of this partnership, and look forward to more installations with Habitat for Humanity throughout our service area."

This first collaboration with Habitat for Humanity was done in part to celebrate Maine Solar Solutions' tenth anniversary. While residential solar projects vary in cost, the full donation is

valued at more than \$10,000. The success of this project is leading both organizations to discuss potential future projects and collaborations.

"The home owners, Derek and Alicia, couldn't be happier with the overall project, including the ability to have lower utility rates, and cleaner energy," said Amy Nucci, Executive Director for Habitat for Humanity York County. "Our mission is to help provide decent, affordable homes to those who might need a little extra assistance making it happen. These are not handouts; they are a hand up in an

increasingly inaccessible homeownership market. Ultimately, we believe that everyone deserves a decent place to live. We are very thankful for the partnership with Maine Solar Solutions and are thrilled with the results on the first home."

According to Habitat for Humanity, Derek has worked in the Kennebunkport area for more than fifteen years after three tours in the Middle East. Derek and Alicia's oldest son requires living space-based health considerations, which have not been easy to find with move-in ready conditions in the community. Being selected by Habitat for Humanity for the Cape Porpoise home has enabled the family to relocate to the area in which Derek works, and start establishing the community their family has been missing.

For information about Habitat for Humanity of York County, visit www.habitatyorkcounty.org.

For more information about Maine Solar Solutions, please visit their website at www.MaineSolarSolutions.com.

ENERGY NEWS

Cont'd from p.2

with high reliability, because the renewables have been pair with appropriately sized batteries.

Now note that near firm wind and solar are the least expensive sources of electricity. Even old, paid-down wind and nuclear are not as cheap. And in fact, NextEra believes that electricity from small modular reactors will cost three to five times as much.

Another article published this month in *PV Magazine* has the title, "Could we see U.S. solar electricity for \$0 per kWh?" (<https://bit.ly/3EJxOwp>) Perhaps we should explain something about that \$0 per kilowatt-hour (kWh). It does not mean the electricity is free. It means that it rounds to zero. The source for the data is a report from Credit Suisse, which says renewable energy can be expected to cost below 1¢/kWh by 2025 in the United States. And the report says it could go as low as 0.4¢/kWh over the following few years – and that really does round to \$0/kWh.

Indeed, the natural gas industry appears to have crashed in the United States. The latest news we got from the *SUN DAY Campaign*. The Federal Energy Regulatory Commission (FERC) keeps track of expected electric capacity additions and retirements. It has a separate category for expected additions that it believes have a high probability of being built in the next three years. According to FERC, the high-probability new capacity pipelines include 67.1 gigawatts (GW) of solar, 17.5 GW of wind power, 3.2 GW of wind power, and 2.2 GW of nuclear. That is a total of 90 GW.

Of that 90 GW, 84.6 GW is solar or wind. That is 94% of all high probability additions. By contrast the 3.2 GW of natural gas in the high probability pipeline is just 3.56% of the total.



(Jason Blackeye, Unsplash. <https://bit.ly/3s3muU7>)

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WILL THE NEW CARBON BATTERY TECHNOLOGY REPLACE LITHIUM FOR ENERGY STORAGE NEXT?

Chris Milner

Battery storage is the fastest growing industry in the United States, with sales expected to exceed \$50 billion by 2028. Grid instability, rising costs of electricity, and politics are the driving forces in the rising demand for battery storage. There are a lot of battery storage products out there, but the information to guide the buyers is confusing at best, leaving them wondering what technology is best for them.

Back in the day, the lead-acid battery was all we knew and standard for energy storage. Batteries were composed of lead plates with sulfuric acid inside. While these were effective and could be long lasting (up to 20 years if not cycled deeper than 20%), they were high maintenance. Every week you would have to check the electrolyte (acid) levels and add distilled water, or they would not last longer than a few years. Since they were non-sealed batteries, you also had to vent them to the outside, so deadly sulfur gas doesn't build up in your home. In the 1970's, AGM (Absorbed Glass Matt) batteries made their first appearance. It was still a lead-acid battery, which used lead plates and sulfuric acid, except now all the acid was absorbed into the plates. This resulted in a maintenance-free battery, which slowly became more and more popular and are now found in all new cars and trucks. The downside of AGM technology, or any lead acid for that matter, is that when left at a state of discharge for a length of

time, the sulfur from the acid sticks to the lead plates causing the battery to lose its maximum capacity. To repair a sulfated battery, de-sulfating formally known as "equalization" would have to be done, which helps restore the batteries' capacity but does affect battery life. All this added maintenance to what was supposed to be a maintenance-free battery. In general, AGM batteries last about six to eight years if not cycled deeper than 50%.

In the 1990's, lithium-ion batteries began to hit the storage market, but due to instability issues, by 1997 they were replaced with lithium iron phosphate (LiFePO4) batteries, which were more stable and are the battery found in most of the energy storage systems today. The lithium battery technology brought a whole new set of benefits to the storage industry; batteries were now available that lasted ten years or more, could be cycled deeper than any other battery technology without damage or sulfating, and were truly maintenance-free, but this great technology comes at a cost. The price of lithium-based batteries is more than double the cost of any other battery technology available, and the process to manufacture the lithium batteries requires dangerous mining of rare earth minerals (cobalt) which have a great impact on the environment, workers' health, and safety. While lithium iron phosphate batteries are safer, they are still not without risk either, if the charg-

ing circuit (called the BMS or battery management system) were to fail, they can overheat and catch fire. As a further impact, lithium batteries are also only 35% recyclable.

Carbon batteries are the latest to hit the U.S. market. While they were invented back in the 1950's, they are just starting to hit the residential market now. Here's what makes carbon the best replacement for lithium in the storage industry. They have the same cycles as most comparable lithium technologies, giving them the same 10- to 20-year life span. They can be discharged 90% without damage just like the lithium counterparts, but there is no dangerous mining and carbon batteries are 100% recyclable. They also cost nearly the same as a standard AGM battery; the only downside is they weigh more so can't be an alternative for electric cars.

How did they do it? Quite simply actually, the issue with the AGM battery was sulfur sticking to the lead plates in a state of discharge, so why not just replace the plates with something better than lead? Well, that is what they did. Carbon, which is one of the most abundant minerals on earth (found in stone and can also be man-made), is also a good conductor of electricity when in its mineral form, but sulfur can't stick to it! So, by infusing carbon into the plates of the battery (there is still a small amount of lead) they are able to make an AGM type of battery that doesn't sulfide up, can be cycled deeply without damage, will last just as long as its lithium counterparts without the expense or hazards, and, because carbon is a natural and stable mineral, it's easy to recycle.

In summary, you can still buy standard lead-acid batteries at a lower price than most technologies out there if you don't mind the weekly maintenance or venting requirements, but carbon batteries have opened a whole new door to the consumer, offering all the benefits of the previous industry-leading battery without all the added cost, dangers, or environmental impacts. Consumers now have a better and more affordable choice than ever before.



Different types of batteries have been available over the years. From top to bottom: Lead-acid battery, AGM battery, Lithium battery, and the new Univix Carbon Battery. (Courtesy photos)



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www.univix.com

603.709.2176

Chris Milner is the CEO of Univix Power Solutions. Chris has a degree in electrical engineering and has over 30 years' experience in the on- and off- grid solar industry working with and owning an installation company. In 2018, Chris co-founded Univix in Laconia, NH with the goal of manufacturing energy storage solutions that were environmentally-friendly, powerful, easy to install and affordable for everyone. ♻️

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.
- ARPA incentives for low- & Moderate-income Vermonters for wood stove change-outs, pellet heating, and bio-diesel (as well as any needed repairs for wood/pellet ventilation/exhaust systems. See details at www.RERC-VT.org
- 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 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.

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: 75% off eligible project costs, up to \$2,000. Moderate income Vermonters get 75% off up to \$5,000.

- 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: \$400 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:

- \$.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:
 - \$.12/rated or modeled kBtu/yr for new solar thermal facilities fifteen collectors in size or fewer; \$.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

-This program offers rebates to qualifying NH residents who install photovoltaic (PV) or wind turbine electrical generation systems. Rebate levels are \$.20 per

watt of panel rated power up to \$1,000, or 30% of the total facility cost, whichever is less. Rebates will be awarded by lottery. All applications are due October 31, 2022. 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

Many towns provide property tax exemptions for renewables. Check your town website for more information.

- *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.energy.nh.gov/energy-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, EFL.

- 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 IN NEW YORK

There are 169 programs and incentives available at: <http://dsireusa.org> (enter your zip code).

Also visit <https://www.nyserda.ny.gov/> All-Programs for the latest NYSERDA solar, ground source and air source heat pumps, EV, residential, and commercial incentives.

Select New York State utilities offer incentives for heat pump systems. Please check with your local utility for more information or to learn more about heat pumps, available rebates, and financing options on the NYS Clean Heat program website at <https://cleanheat.ny.gov/>.

Clean Energy Incentives and Tax Credits for Renewable Energy

- **SOLAR:** The federal investment tax credit (ITC), which was scheduled to drop from 26% to 22% in 2021, will stay at 26% through 2022.

- **ADVANCED WOOD HEAT:** A 22% investment federal 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% federal tax credit was also extended for geothermal heat pump projects that begin construction in 2022. NY homeowners are eligible for a 25% State tax credit up and additional incentives could be available from their utility provider.

- **AIR SOURCE HEAT PUMPS:** Most utilities also offering incentives on both central air source heat pump systems as well as mini-splits.

Electric Vehicle Charging Station Make-Ready Program

- National Grid and other utilities 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: 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.effi>

ciencymaine.com/at-home/vendor-locator/.

Heat and Cooling: Rebates and financing for the installation of high-efficiency equipment. To find out more about heating solutions, for your home go to: <https://www.efficiencymaine.com/heating-solutions/>. For business heating and cooling solutions go to: <https://www.efficiencymaine.com/at-work/heating-and-cooling-solutions/>. Homeowners can estimate their annual heating costs for different heating systems using the Home Heating Costs Calculator here: <https://www.efficiencymaine.com/at-home/heating-cost-comparison/>. To find a vendor go here: https://bit.ly/EffME_VendorLocator. To find a qualified partner for business solutions, go here: https://bit.ly/EffME_BusinessSolutionsPartner.

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: \$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, including multifamily buildings with five units or more and Maine's largest energy customers, businesses, for profit or nonprofit; municipalities; schools and higher ed facilities; industrial facilities; non-residential facilities; multi-family and condominium buildings with five+ units. To learn more about incentives for energy efficiency solutions, how to get started, and program details, visit <https://www.efficiencymaine.com/at-work/>. To find a contractor participating in Efficiency Maine programs as a Qualified Partner: https://bit.ly/EffME_BusinessSolutionsPartner.

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.

\$100 "DIY" Winter Prep Rebate toward the purchase of select weatherization and insulation products. Complete promotion details, a list of eligible products, and a claim form can be found on the Efficiency Maine website at <https://www.efficiencymaine.com/at-home/100-diy-winter-prep-rebate/>

USDA INVESTS \$121 MILLION IN CRITICAL INFRASTRUCTURE TO COMBAT CLIMATE CHANGE ACROSS RURAL AMERICA

15 Projects in New Hampshire and Vermont Funded through Rural Energy for America Program (REAP) Grants

On August 24,, U.S. Department of Agriculture (USDA) Deputy Secretary Dr. Jewel Brnaugh announced USDA is investing \$121 million in critical infrastructure to combat climate change across rural America. The funding will include grants for 15 energy-efficiency and renewable-energy projects throughout New Hampshire and Vermont.

"Rural America is on the front lines of climate change, and our communities deserve investments that will strengthen all of our resilience," Brnaugh said. "The Biden-Harris Administration has created a roadmap for how we can tackle the climate crisis and expand access to renewable energy infrastructure. The investments we're announcing today and those that will be made possible by historic funding from President Biden's Inflation Reduction Act will strengthen our energy security, create good-paying jobs and save Americans money on their energy costs."

The funding will help people in 49 states, Guam and Puerto Rico. It reflects the many ways USDA Rural Development helps rural residents, businesses and communities address economic development, infrastructure and social service needs.

"With USDA's help, Vermont and New

Hampshire farmers, agricultural producers and businesspeople are adapting to a changing climate by reducing both their costs and carbon footprint," said Sarah Waring, State Director for USDA Rural Development in Vermont and New Hampshire. "These essential projects sustain the health of our rural communities, underscoring the Biden-Harris Administration's commitment to strengthening energy security. This funding and the historic Inflation Reduction Act will continue to save Americans money, create jobs and increase access to renewable energy infrastructure."

These investments reflect the goals of President Biden's Inflation Reduction Act, which addresses immediate economic needs and includes the largest ever federal investment in clean energy for the future. For example, the Act includes \$14 billion in funding for USDA programs that support the expansion of biofuels and help rural businesses and electric cooperatives transition to renewable energy and zero-emission systems.

Background:

Brnaugh highlighted a total of 415 investments that USDA is making through three programs specifically designed to help people and businesses in rural areas.

These programs are Community Facilities Disaster Grants, Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants, and Rural Energy for America Program Energy Audits and Renewable Energy Development Grants.

The investments will help state and local government entities, nonprofit organizations, and federally recognized Tribes construct, renovate or purchase and install equipment for essential community facilities for public use in rural areas. They also will help agricultural producers and rural small businesses purchase and install renewable energy systems as well as make energy efficiency improvements.


Some examples include:

- Wilkins Sawmill in Milford, New Hampshire, will use a \$7,604 REAP grant to retrofit its facilities with LED lighting and install electrical control devices to improve and stabilize electricity use from equipment, saving an estimated \$3,900 annually
- In Townshend, Vermont, Big Picture Farm will replace 98 percent of its energy consumption through a 32.7kW roof-mounted solar array to save \$7,000 per year, courtesy of a \$18,039 REAP grant, while producing its award-winning

farmstead confections and cheeses.

- The Community College System of New Hampshire will use a \$91,304 grant through the Energy Audit and Renewable Energy Development Assistance program to support NH Rural Renewables, which benefits 44 rural small businesses and agricultural producers with solar photovoltaic and wood thermal energy, and other energy-efficiency technologies.

- Staff at the VT NH Veterinary Clinic, a 70-year-old practice in East Dummerston, Vermont, received a \$16,378 REAP grant to install a 20.7kW solar array, replacing 76 percent of the clinic's energy usage and saving \$4,200 annually.

Under the Biden-Harris Administration, Rural Development provides loans and grants to help expand economic opportunities, create jobs and improve the quality of life for millions of Americans in rural areas. This assistance supports infrastructure improvements; business development; housing; community facilities such as schools, public safety and health care; and high-speed internet access in rural, Tribal and high-poverty areas. For more information, visit www.rd.usda.gov. If you'd like to subscribe to USDA Rural Development updates, visit our GovDelivery subscriber page. 

East Coast Sea Level Rise – Cont'd from p.1

intermediate value of 4%, each inch of rise in the sea would mean a loss of 25 inches of beach. A rise of eight inches would mean a loss of over 16 feet of beach. Sea levels are currently rising at 0.14 inches per year. Between now and 2050, the sea may rise by close to four inches (<https://bit.ly/3CCzkz4>).

While losing beach area can help us visualize what an inch of sea level rise means, there are other effects that are much more important. Dennis made this clear when he spoke of the 152,000 acre Alligator River National Wildlife Refuge (ARNWR). It was established in 1984 to protect a rare type of wetland, called a pocosin, which exists because unusual geology produces a rare type of ecology based on a relationship of salt and fresh water.

Unfortunately, ARNWR is already being destroyed by sea level rise. Salty water is infiltrating into areas where the underground water is fresh. This is happening because the rising sea is causing salt water to move farther than previously, overwhelming fresh water with devastating ecological results.

ARNWR had marshland, shrubland, and forest. Since its establishment, trees in some areas of forest have died, because they could not survive with the amount of salt in their water. This produces what is termed a ghost forest. The dead forest is overtaken by shrubs that have greater salt tolerance. Not far off, however, shrubs

have died because of even higher amounts of salt in available water, so the shrub land is becoming marsh. And not far off from that, the marsh has been overtaken by the sea itself.

Another type of damage from sea level rise comes from high tide flooding events. These have come with the high tides that accompany periods of the full moon and new moon, when the tides are highest because the sun, moon, and Earth are aligned. With sea level rise, they are much higher than ever before, and floods increasingly happen at other times of the month.

Because most streets in East Coast cities were designed before engineers knew

about sea level rise, they are vulnerable to higher tides than we had in the past. At the highest tides, sea water runs up the storm drains and comes out on the streets causing floods that can even happen on sunny days. This is already a problem in a number of coastal cities.


Higher tides are not a remote problem in the Northeast. Nor is it confined to coastal regions.

Park in Manhattan have risen six inches in the last 48 years, but they are expected to rise another six inches in the next sixteen years (<https://bit.ly/3ryUGqw>). NOAA has expected seas to rise another 10 to 12 inches by 2050 (<https://bit.ly/3M6LOSf>). But there is more news about that in the article "Zombie Ice in Greenland," on page 22 of this issue.

On the U.S. Atlantic coast, flooding is expected to be far more frequent, very soon. Cities on the East Coast and Gulf Coast have seen increases of 400% to 1,100% since the year 2000, according to NOAA (<https://bit.ly/3C8MBh7>). By the year 2050, flooding in some areas is expected to happen as many as 75 days per year. That is enough to put a serious dent in business.

Storms cause more damage with greater sea level rise. The federal government has tracked insurance claims, because it has guaranteed them since 1968. Finding that some homes were being rebuilt repeatedly, Congress passed the National Flood Insurance Act of 2004, which limited the number of claims a property could have to two claims of over \$1,000 during a period of ten years. Properties with more claims lost their guarantee of insurance.

Nevertheless, the National Flood Insurance Program went into debt. Congress canceled \$16 billion in debt in 2017, so the program could pay claims. By the end of 2020, the program owed over \$20 billion (<https://bit.ly/3Md7RHo>). And as we write this, Hurricane Ian is said to be the most expensive storm ever to hit Florida.

The sea level is rising, and with that, things are getting worse much faster than many of us might have thought possible. The best time to act on this has already passed. But it is vital that we act now, to limit the upcoming damage as much as we can. 



Above: High tide flood in Charleston, S.C. (NOAA image). Right: Ghost forest in the Alligator Forest National Wildlife Refuge. (NC Division of Water Resources, CC0 1.0, public domain)



At Hartford, Connecticut, the Connecticut River is at about the same level as the ocean, and so it could be affected by tides. In fact, communities along the Hudson River will almost certainly have similar problems.

Green Energy Times has had articles before about the effects of sea level rise in places like Florida and Louisiana. One example, published in 2018, is "The Time to Act is Now!" (<https://bit.ly/3SALCqG>) Nearer to us, a forecast for New York City says that average sea levels at Battery

AUGUST TEMPERATURE UPDATE, A “THANK YOU,” AND BIDEN’S REPORT CARD

James Hansen, Makiko Sato, and Reto Ruedy

The past three months were remarkably warm on global average – remarkable because this is a La Nina year, when the cool phase of the El Nino Southern Oscillation keeps the low latitude Pacific Ocean relatively cool. These three months – Northern Hemisphere summer – were each at or near records for the month (Fig. 1), despite the La Nina. Every month this year has been warmer than the same month last year (Fig. 1), even though the present La Nina is as deep as last year (Fig. 2).

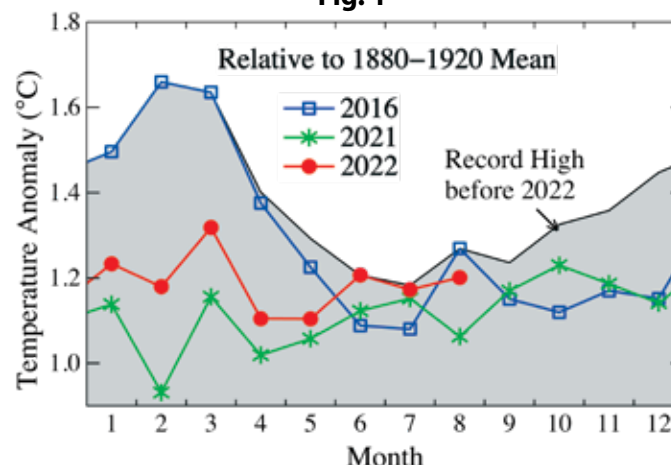
Our interpretation is that the current warmth is spurred by the record Earth energy imbalance, which in turn is spurred by rapid growth of greenhouse gases,[1] reduction of human-caused aerosols,[2] and the rising phase of the solar irradiance cycle. NOAA and the relevant scientific community predict that the La Nina will continue at least through this coming winter, for a third consecutive year.[3]

El Nino/La Nina are the largest cause of global temperature variability on the time scale of a few years and they are notori-

ously difficult to predict more than a few months ahead. Nevertheless, we have some inside information, which encourages us to hazard a prediction for the next three annual mean global temperatures – we might then learn something from comparison with future reality. Prediction of the annual 2022 global temperature is child’s play at this point: the final four months this year should average higher than the same months last year, so the 12-month running mean at the end of this year will have ticked up to about the level in 2017. That will put 2022 in approximately a dead heat with 2017 for 4th warmest year in the record.

The next year, 2023, will be warmer

Fig. 1



because of the present strong planetary energy imbalance, which is driven by the factors noted above – mainly increasing greenhouse gases. Perhaps an El Nino will begin in the second half of the year, but the El Nino effect on global temperature lags by 3-4 months. So, the 2023 temperature should be higher than in 2022,

rivaling the warmest years.

Finally, we suggest that 2024 is likely to be off the chart as the warmest year on record. Without inside information, that would be a dangerous prediction, but we proffer it because it is unlikely that the current La Nina will continue a fourth year. Even a little futz of an El Nino – like the tropical warming in 2018-19, which barely qualified as an El Nino – should be sufficient for record global temperature. A classical, strong El Nino in 2023-24 could push global temperature to about +1.5°C relative to the 1880-1920 mean, which is our estimate of preindustrial temperature.

Petition to EPA to regulate CO2 emissions. Thanks very much to all the people (more than 1000) who endorsed our petition to EPA to regulate CO2 emissions using the Toxic Substances Control Act (TSCA).[4] We made a second trip to Washington to encourage EPA to use its existing authority under that law (TSCA), which was strengthened by Congress in recent years with bipartisan support. CO2 fits the law’s definition of a toxic substance to a T.

Cont’d on p.23

IRA: Biggest Climate Investment in U.S. History – Cont’d from p.1

- The transition will help prevent future inflationary pressures caused by spikes in fossil fuel prices, or what economists call “fossilflation.”
- By helping more Americans afford electric vehicles (EVs), the bill will reduce fuel costs for those EV owners by over \$500 annually.
- By accelerating the deployment of clean, cheap electricity, energy modelers project that the IRA will save the average household about \$200 per year in electricity costs, without households taking any action to go green.¹

Individual households also benefit in that the IRA covers 100% of the costs of certain upgrades (up to \$14,000) for low-income homeowners and 50% of the costs for middle-income households. The home electrification and efficiency rebates in the bill include:

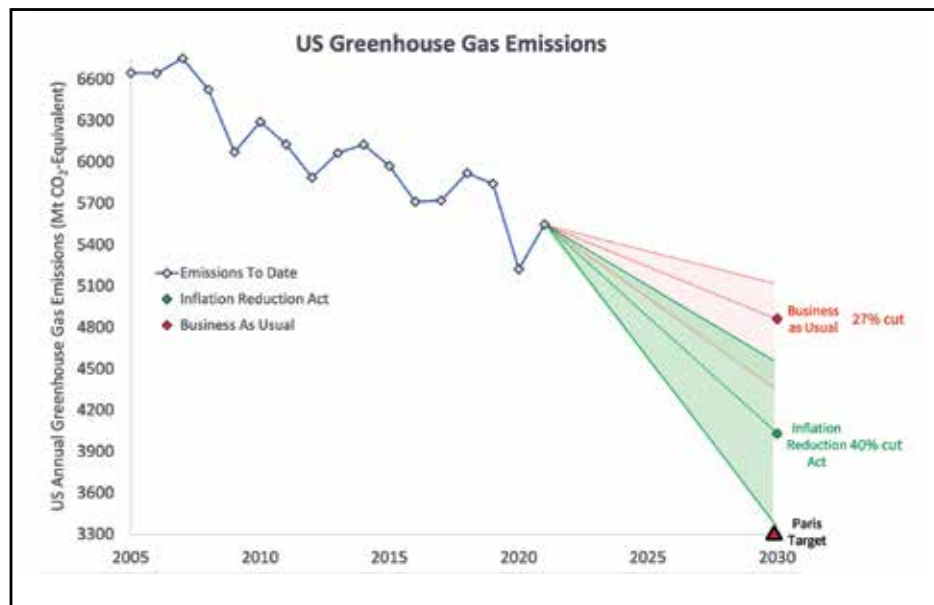
- heat pumps for heating and air conditioning, water heaters, and clothes dryers;
- electric stoves;
- home weatherization such as improved insulation and windows;
- rooftop solar and battery storage; and
- wiring and breaker-box upgrades.

Rewiring America provides a useful calculator on what individual households can expect: <https://www.rewiringamerica.org/app/ira-calculator>.

Powering the Economy of the Future

Today we get about 40% of our electricity from “clean” (non-fossil-fueled) sources such as wind, solar, nuclear, and hydro-electricity. With the IRA, that is expected to roughly double, to as high as 85% of overall sources of electricity in 2030. Most of that increase will come from wind and solar farms, which are expected to approximately triple from today’s levels.

New car and truck sales are also expected to be electric in 2030. Some estimates say it could be more than half, up from about 5% in the U.S. today. And by promoting domestic manufacturing and supply chains and innovation, the investments from the bill are projected to create about a million new jobs in clean energy, manufacturing, and building electrification and efficiency upgrades. This will also protect us from supply chain



Sources: EPA GHG emissions inventory, Rhodium, Energy Innovation, Princeton REPEAT, and US DOE analyses. Chart by Dana Nuccitelli, Citizens’ Climate Lobby.

disruptions and reduce dependence on countries with environmental issues, human rights abuses, and dictators.²

Investing in Disadvantaged Communities

Disadvantaged communities which face major health and environmental challenges due to pollution and climate change will get money for community-led environmental justice projects, to improve transportation access equity, to reduce pollution at transportation hubs including ports, railways, airports, and also near schools, and for grants to improve the energy efficiency of affordable housing.

This includes funding from the Greenhouse Gas Reduction Fund, also known as the Green Bank, to finance emissions reductions in disadvantaged communities. Over 20,000 jobs will be created in disadvantaged communities to support these programs.³

Good for Urban and Rural Communities

Cities that need to retrofit buildings or modernize their public transit will be eligible for EV and public-transit charg-

ing infrastructure from the bipartisan infrastructure bill and tax credits from the IRA. The IRA also includes grants for cities to get electric garbage trucks and buses to reduce local air pollution, and to grow urban forests which will lower temperatures and protect residents from dangerous extreme heat.⁴

Rural communities are eligible for money to lessen the impacts of extreme wildfires and droughts. This includes a combined \$7 billion between the bipartisan infrastructure bill and the Inflation Reduction Act for wildfire prevention, and \$4 billion in drought funding to compensate farmers who reduce their water use and for rural communities to mitigate the environmental effects of shrinking inland water bodies. Rural electric cooperatives, which serve 42 million Americans will now be eligible for direct-pay clean energy tax credits and a \$9.7 billion grant and loan program for new clean energy systems.

Most new electricity projects are built in rural areas where land prices are affordable; those projects will generate hun-

dreds of billions of dollars in value and tens of thousands of jobs in rural communities over the next decade.⁵

Farmers, ranchers, and foresters will benefit from the IRA. The bill directs over \$20 billion to popular conservation programs like the Environmental Quality Incentives Program that can be used for climate-smart agriculture and forestry projects. It also provides \$2 billion for rural clean energy via the Rural Energy for America Program. On top of that, \$450 million goes to the Landscape Scale Restoration Program, which helps private landowners adopt climate-smart forestry practices. And, the bill includes \$700 million for preserving forests on private lands via the Forest Legacy Program. The reduced air pollution resulting from the transition to clean energy will also increase American farmers’ crop yields to the tune of \$400 million per year, because fossil fuel ozone pollution reduces crop yields.⁶

What’s Left to Do?

The Inflation Reduction Act and other climate legislation passed in 2021 and 2022 are steps in the right direction and get us moving, but they still leave us shy of our Paris commitment to cut U.S. carbon pollution 50% below 2005 levels by 2030. We need to close the rest of that gap, and then keep working towards reaching net zero emissions by 2050. We can do that by lobbying at the Federal level for a carbon fee and dividend, more electrification and efficiency programs, and agricultural policies that encourage carbon sequestration.

Individual consumers making forward-thinking choices are laudable but by themselves do not change public policy or reshape the future; citizen advocacy is what got us this far and joining Citizens’ Climate Lobby or other like-minded groups is needed to get us the rest of the way.

Footnote links provided in the online posting of this article at greenenergytimes.org.

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

The Electric Vehicle Revolution is Accelerating

Sherry Boschert

Society's transition to electric drive is picking up speed, judging by numerous regional projects related to electric vehicles (EVs).

EV drivers and want-to-be EV drivers across New Hampshire are communicating with each other on a new NHEV listserv and starting to harness the political clout of the EV-driving public. Ford Motor Company delivered one of the first Ford F-150 Lightning electric pickup trucks in the nation to the City of Lebanon, N.H. in September for use by city staff. Maine is becoming a leader in available fast-charging stations. Electric school buses are rolling into Vermont and Maine. Some will be part of a pilot project testing the benefits of vehicle-to-grid technology, in which some electricity in the bus batteries is fed back into the electrical grid at strategic times of day and then replaced at lower-cost times.

In New Hampshire, EV drivers and supporters can subscribe to the new NHEV listserv at <https://groups.google.com/g/nhev> to communicate with each other, post used EVs for sale, and strategize on projects to promote the transition to electric drive. In this election year, NHEV drivers realized they could speak up for the owners of more than 4,800 EVs and plug-in hybrid EVs that were registered in the state as of 2020. They are creating a questionnaire for political candidates, whose responses will be used to create an "EV Scorecard" to help inform voters.

Dozens of curious people stopped by Lebanon's display of its new Ford F-150 Lightning EV truck at the Lebanon Farmers Market on September 1. Kids enjoyed climbing into the open "frunk" – the front



The City of Lebanon, N.H. displayed its new Ford F-150 Lightning electric pickup truck, one of the first delivered in the country, at the Lebanon Farmers Market on September 1. Lebanon, N.H. Assistant Mayor Clifton Below looked over the city's new electric pickup truck. (Photos: Sherry Boschert)

trunk, which is 14 cubic feet of extra space where an internal combustion engine would be in a non-electric truck. Adults often murmured surprise and approval of the relatively reasonable cost of the Lightning, which Lebanon bought for approximately \$43,000.

The Lightning comes with 426 horsepower, all-wheel drive, a payload capacity of 2,000 pounds, and a towing capacity of 7,700 pounds. Placed around the truck are ten 120-volt electric outlets for plugging in equipment, one 240-volt outlet, two

12-volt outlets, and eight USB ports. The truck accelerates from zero to 60 miles per hour in five seconds, has a range of 230 miles on a full charge, and charges up from 15% full to 100% full in 40 to 90 minutes on a fast charger or overnight (10 hours) on a Level 2 charger.

The State of Maine fast is becoming a good place to find a public fast charger that serves EVs other than Teslas, which have their own fast-charging network. Using funding provided by Volkswagen in a legal settlement over fraud charges, Maine has powered up or started construction on 14 DC Fast Charging (DCFC) stations, according to ReVision Energy, which helped install the chargers. These include two of the first public very-fast DCFC chargers capable of delivering 150 kW, at Main Turnpike's Kennebunk and West Gardiner service plazas. Older DCFC fast chargers delivered up to 50 kW. Maine plans to install more fast chargers in anticipation of federal infrastructure funding.

A few short minutes after Maine activated its fast chargers at Kennebunk North service plaza, a brand-new Proterra/Thomas electric school bus rolled out of the build factory of WC Cressey and Son in Kennebunkport and pulled in to charge, said eye witness Dan Robinson, a project manager for ReVision Energy. After charging up, the bus headed to the next DCFC charger at the Skowhegan Hannaford on the way to its destination of Old Town, ME.

The Volkswagen legal settlement also is funding four EV school buses for the Burlington, VT. School District plus DC fast chargers for them. These aren't your average EV buses and chargers, though. In a pilot project coordinated with Green Mountain Power, the bus batteries will send some of their stored power to the electrical grid during outages through bidirectional vehicle-to-grid technology, the district's director of operations and finance, Gary Marckres, said in a webinar about electric school buses.

Green Mountain Power may tap the bus battery power during peak-load times

of day to reduce its need for high-priced electricity in those hours from New England's Regional Network Service. The school district would be given a credit on its utility bill based on the avoided expense, and the buses would be recharged when more and cheaper electricity is available, Green Mount Power's Emily Eckert explained in the webinar.

Separately, Green Mountain Power replaced one of its aging heavy-duty field maintenance team trucks in Rutland with a Lion EV stake body truck that has a 200-mile range. The utility also has an EV line truck on order. Combined, these should eliminate 100 tons of carbon emissions per year plus a virtual ton of noise and will include vehicle-to-grid technology, Green Mountain Power's Tiana Smith said in a press release.

Not to be outdone, the summer parade in Londonderry, N.H. featured an electric garbage truck which has been used around town.

News items like these and many more paint a picture of Americans putting the pedal to the metal in the transition to electric drive. Now, if only automakers can keep up with demand.

Sherry Boschert is a co-founder of Plug In America and author of a new book on a different topic, 37 Words: Title IX and Fifty Years of Fighting Sex Discrimination (The New Press, 2022). ♻️



Green Mountain Power replaced one of its aging heavy-duty field maintenance team trucks in Rutland with a Lion EV stake body truck. (Courtesy photo)

CAN THE ELECTRIC GRID HANDLE CHARGING ALL THOSE EVs?

George Harvey

During the recent heatwave in California, grid authorities asked owners of electric vehicles (EVs) to delay charging them for a few hours to avoid additional demand at just the time when demand was highest. Ironically, this came only a few days after the state's legislature voted to ban sales of cars powered by fossil fuels in 2035.

Of course, those who hate the idea of reducing our consumption of oil and gas were gleeful about the irony, using it as a sort of proof that the grid will not be able to handle charging all the EVs, when they start to become dominant. But jokes and name-calling are not the same as facts and carefully considered opinions.



Proterra electric school bus. (Proterra image)

We might begin by pointing out that the grid authorities did not ask EV owners not to charge them. They asked that charging be delayed a few hours. Since many people who own EVs charge them at home overnight, this did not represent

any real problem.

But what about the future? We will be increasing EV use all across the country, and we should be sure that the electricity will be there to support them. That truly is something that needs consideration and design. We need to start by looking at whether an all-renewable grid can supply the electric-powered replacements for all the cars we have with

all the electricity they need.

Let's step back and take a look at the broader picture. We will be increasing a lot of things in this country at the same time that we grow the use of EVs. Predictably, we will have more distributed

power, and this especially includes home installations of solar power. We will have community solar and utility-scale power generation of all types added.

Technology will change. This is to some degree unpredictable, but some of it is easy to foresee.

We can be sure that demand response will become common, because the move in that direction is already underway. Demand response is rather simple technology that allows utilities to delay use of heavy demand loads during time of high overall demand. If the day is very hot, an electric clothes dryer might not turn on until the utility knows it can cover the demand. Similarly, the time an EV starts to get charged might be delayed until after 9:00 PM. This is under consumer control and can be overridden.

We can also be quite sure that vehicle-to-grid (V2G) technology will be coming also, because it is well along in development. If a car and a charger are both built for V2G, a

Cont'd on p.21

CLEAN VEHICLE FEDERAL TAX CREDIT: IMPORTANT CHANGES YOU NEED TO KNOW

Molly Passalacqua

On August 16th, President Biden signed into effect the Inflation Reduction Act. A major goal of this act is to combat global climate change by encouraging individuals to purchase "clean" vehicles, such as electric or plug-in hybrid, and moving production to North America.

If you are in the market for a new vehicle, there are important changes to the qualifications of eligibility for the Federal tax credit as it pertains to clean vehicles.

New Vehicles:

- Existing \$7,500 electric vehicle "EV," tax credit extended from 2022 to 2032
- Income limits (modified adjusted gross income) imposed to qualify for the tax credit - \$150,000 for single filers, \$300,000 for married filing jointly and \$225,000 for head of household
- Large vehicles (Vans, Trucks, SUVs) listed for over \$80,000 do not qualify for the credit
- Cars listed for over \$55,000 do not qualify for the credit.

Used Vehicles:

- 'Used' is defined as a two-year old model. If it is bought from a dealership (first owner) then it qualifies. If it is a private sale, it does not qualify as the original owner received the tax credit.
- New \$4,000 EV tax credit or 30% of purchase price, whichever is lower
- Previously owned vehicle does not qualify for credit
- Income limits (modified adjusted gross income) imposed to qualify for tax credit - \$75,000 for single filers, \$150,000 for married filing jointly and \$112,500 for head of household
- Vehicles listed for over \$25,000 do not qualify for the credit



<https://burst.shopify.com/>

Qualifying Vehicles:

- Clean Vehicles, including electric, plug-in hybrid and certain commercial vehicles
- Final assembly, and certain components, must be sourced and occur in North America. A current list of eligible vehicles is maintained through the Department of Energy. <https://afdc.energy.gov/laws/inflation-reduction-act>
- Used vehicles are not required to meet the new vehicles' North American sourcing/assembly requirement like new vehicles

Purchase vs Lease

- Credit only applies to purchased vehicles. For leasing, the lessor receives credit for leased vehicle but can be used as a negotiation point for lease terms
- Certain states, including Vermont, offer tax incentives regardless of leasing or buying

Purchased in 2022?

- Eligible for tax credit under prior rules if sales contract is signed before August 16, 2022; car may be delivered in 2023
- Car manufacturer caps eliminated in 2023, but in effect for new cars purchased

between August 16, 2022, and December 31, 2022

How to get the credit?

- In 2024, dealerships will be offering the credit as a discount to the purchase price
- At tax filing, account for the credit for vehicle purchased in the previous year in partnership with your CPA or via form 8936

Please reach out to Copper Leaf Financial if you have any questions about this article. Another great resource

for clean vehicle information is the Drive Electric Vermont website. Please note that the Inflation Act covers more than just clean vehicle changes, so if you have questions about the larger effect it has on you and your household, you can reach out to us at Copper Leaf Financial or contact your Tax Advisor. You can also reach out to Copper Leaf's affiliated and separately registered CPA firm Davis & Hodgdon CPAs.



Molly Passalacqua is a Wealth Advisor, Certified Wealth Strategist (CWS®) for Copper Leaf Financial. Copper Leaf Financial works closely with clients, providing recommendations on many things including big purchases. For example, to discuss leasing vs. buying, electric vs. fuel, when it is time to buy a car or provide strategies around reducing income to meet eligibility for tax credits when possible.

Resource links:

https://bit.ly/kiplinger_EVTaxCredit_IRA
https://bit.ly/irs_PluginEVCredit
https://bit.ly/forbes_EVtaxcredit
<https://bit.ly/EV-Tax-Credit-FAQs>

Many thanks to our sponsor:



VERMONT'S NEW 'REPLACE YOUR RIDE' FUNDS CLEAN OPTIONS FOR TRANSPORTATION



(Courtesy image: Vermont Agency of Transportation)

Under the Replace Your Ride program, incentives of \$3,000 are available on a first-come, first-served basis to income-eligible Vermont residents who retire a working, high-polluting vehicle that is at least ten years old and switch to a new or used plug-in electric vehicle.

The program uses the same income eligibility requirements as Vermont's Incentive Program for New Plug-in Electric Vehicles and MileageSmart, the state's used vehicle incentive program. In this first phase, applicants for Replace Your Ride will be eligible to stack the \$3,000 incentive with one of the existing (new or used) plug-in electric vehicle incentives. Information on these programs is available at Drive Electric Vermont's website (<https://www.driveelectricvt.com/incentives/vermont-state-incentives>)

The second phase of the program is set to begin November 2. At this time, participants will be able to choose alternatives to personal car ownership. Eligible applicants can receive a card loaded with a \$3,000 voucher to use on eligible clean transportation expenses at participating electric bike shops or for shared mobility options. ♻️

Many thanks to our sponsor:



<< Electric Grid - Cont'd from p.20

car that is plugged in during the high demand times could supply some of its power to the grid, if the owner allows it. This means that EVs can have a positive effect on the grid, smoothing out demand.

Battery prices are falling fast. According to an article last December at InsideEVs.com, the price per kilowatt-hour of EV batteries dropped from \$1,200, in 2010, to \$132 in 2021 (bit.ly/battery-price-fall). Also, while we are dependent on lithium in cars today, that may change as better and less expensive types of batteries are developed.

EVs have been less expensive than fossil fuel-powered cars, over the lifetime of the vehicle, for some time, according to an article of June 23, 2021 in *The Hill* (bit.ly/EV-vs-gas-costs). The market has been in turmoil for most of this year, because of the Russian war in Ukraine, but we hope that will not last forever.

Clearly, we will have more EVs in the future, but just as clearly, many of them are likely to be charged at a time when it is convenient for the grid to charge them. This will seldom represent any problem

for the owner, because it will be largely invisible. But also, EVs that are plugged in during the daytime are likely to help even out grid demand by use of V2G technology.

One other aspect of this is that electricity demand will rise as the world converts to use of electricity for nearly all of its major energy needs. However, there is also another side of this story. As distributed power becomes more important, the nature of the grid will be altered.

The design of the grid will need to be upgraded to deal with the EVs that will be coming along in the next thirty years. But we can expect that to happen. With the design upgrades, the grid can be stronger and more reliable because of the addition of EVs.

That change is already coming about. For example, a story at *CleanTechnica* says that in Maryland, the Montgomery County Public School District is switching to electric buses, but they will have V2G technology to strengthen the grid (<https://bit.ly/3SUJbPH>).

So, the short answer is, "Yes, the grid will be able to handle all those EVs. Unless we do something really stupid." ♻️

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Can We Ever Become Sustainable?

John Bos

The media, like *Time Magazine's* recent "Earth Inc." issue, is full of opinions about capitalism being the cause of our climate crisis. I confess that until recently I shared that prevailing liberal-left critique of capitalism as espoused by Herman Daly, a leading expert in the field of ecological economics. Daly maintains that the current economic system is at the heart of the climate breakdown and outlines the policy steps that the world must take in order to achieve a sustainable future. "Sustainable" is the key word here.

My brother, a biomass facility developer, has challenged my perspective. He quotes Winston Churchill who, in October 1945 said, "The inherent vice of capitalism is the unequal sharing of blessings. The inherent virtue of Socialism is the equal sharing of miseries." He also reminded me that in the early fifties our father conveyed to us that he believed that unregulated capitalism was the cause of the unequal sharing.

I suggest it's not the capitalist system itself, but the people and entities that "work" that system who are responsible for our planet's increasing inability to support the human race. This includes politicians who are dependent for their jobs upon financial support of their election campaigns from corporate "influencers."

Capitalism is described as an economic system based on the private ownership of the means of production and their operation for profit. Central characteristics of capitalism include capital accumulation, competitive markets, price systems, private property, property rights and wage labor. In a capitalist market economy, decision-making and investments are determined by owners of wealth, property and the ability to maneuver capital in financial markets - whereas the prices and the distribution of goods and services are mainly determined by competition in various markets.

Economic growth is the primary characteristic of all capitalist economies throughout the world. Capitalist systems, with varying degrees of direct government intervention, have become prevalent in the western world, although the rise of authoritarianism is beginning to replace some of them. That said, it is direct government "intervention" in the capitalist system (including taxation and corporate subsidies) that has changed enormously from the period 1944 to 1951 when the highest U.S. marginal tax rate for individuals was 91%, and when the economy was supporting a growing middle class. This tax rate increased to 92% for 1952 and 1953 and then reverted to 91% in 1954 through 1963. Today the highest marginal tax rate is 37%. And the middle class is declining.

We are living in a world economy based on minerals. From the buildings we inhabit to the infrastructures that supply them, from the machines that move us around to the energy networks that power them - they are all based to a large extent on materials that are extracted from the earth's thin outer crust. Minerals that have taken millennia to form are being extracted in a tiny blip on the earth's timeline. Despite our continued reliance on wood, modern societies rely more heavily than ever on extracted minerals.

Capitalism blossomed when the world was full of seemingly inexhaustible resources. Resource extraction has historically caused dramatic environmental damage throughout the world, but the industrial revolution is long gone. The threat to the human race of doing business as usual is increasing exponentially.



The April 25 - May 2, 2022 issue of Time Magazine focused on opinions about capitalism being the cause of our climate crisis. Photo illustration on the magazine cover is by C.J. Burton.

With only 100 companies responsible for 71% of global emissions and many more bringing up the tail end of pollution, we must make a fundamental change IF we want the world to provide a sustainable environment for us to live in.

In the three decades since the climate crisis has become part of the global agenda, scientists, activists, and politicians have largely assumed that government would need to dictate the terms of the transition. However, legislative attempts around the world to tackle climate change have repeatedly failed. And investors and corporate executives have become keenly aware of the threat that the growing transition to renewable

energy threatens their bottom line. The unregulated capitalist economic system that rewards corporate profit over the "expense" of killing everyone else should be seen as a system that encourages crimes against humanity.

Herman Daly, a former senior economist at the World Bank, in an August interview on *Truthout*, maintains, "A lot of ideological ink is wasted arguing over whether it is population increase or per capita consumption increase that is responsible for excessive scale."

"Neither of these factors can be neglected," Daly asserts. "In my lifetime, world population has quadrupled [from two to eight billion], while [highly variable and unequal] per capita consumption has grown even more, perhaps nine-fold depending on how measured."

Daly leads us to the concept of sustainable capitalism that is surfacing in academia, think tanks and the media these days. It is not a new concept. The roots of sustainable capitalism date back to 1999, when the term "natural capitalism" was coined by authors Amory and Hunter Lovins, co-founders of the Rocky Mountain Institute, who together with Paul Hawken, wrote *Natural Capitalism*, a book that has been translated into more than 30 languages. They are calling for the reintegration of ecological (as well as economic) goals into business. Controversy, of course, surrounds the concept as it requires an increase in sustainable practices and a marked decrease in current consuming behaviors.

Can we ever become sustainable?

John Bos is a contributing writer for Green Energy Times and a columnist for the *Greenfield, MA Recorder*. He is the editor of a new book for children, *After the Race*, and lead editor of *Words to Live By*, a book of 50 poems by acclaimed writers embraced within images from nature created to support people diagnosed with cancer. Comments and questions are invited at john01370@gmail.com. ☺

Greenland's "Zombie" Ice Is Melting Fast

George Harvey

Recently, we have been hearing about "zombie ice." It sounds scary, but that is what the people reporting about it want you to understand. We should take a look to see what it really means.

Greenland has always had a lot of snow, and in normal years more has fallen than has melted, so it has built up. In fact, it has built up to be thousands of feet thick in places. New snow packs down older snow, and the farther down you go in it, the harder it gets. Not all that far down, it is just ice. When ice is thick enough, it is weighted down enough to form glaciers. The distinguishing feature of glaciers is that they flow, very slowly, toward lower elevations. Eventually, the ice makes it to the sea and breaks into icebergs.

Over the past few decades, Greenland has had more ice melting than builds up. The glaciers have been moving toward the sea, but they have been getting thinner. We already knew about that.

A recent study in *Nature Climate Change* shows that in some areas, there is a lot of ice that is not advancing toward the sea (<https://go.nature.com/3e2Qlsv>). Instead, it is simply melting in place, be-

cause it is not being fed by enough snow-fall and it is not getting any contributions from glaciers. This ice will all eventually melt, though we do not know quite when. William Colgan, a glaciologist at the Geological Survey of Denmark and Greenland

and a co-author of the study, told the Associated Press, "It's dead ice. It's just going to melt and disappear from the ice sheet. This ice has been consigned to the ocean, regardless of what climate (emissions) scenario we take now." (<https://bit.ly/3Ebv1vH>)

We should understand that the terms "dead ice" and "zombie ice" do not appear



Glacier in Greenland. (Annie Spratt, Unsplash. bit.ly/3ebmcqZ)

in the report itself. I have no doubt that reporters took the comment about dead ice and invented the term zombie ice to get people's attention.

Regardless of where the term came from, however, the idea that the ice melt should

be regarded as scary is valid. The study says the sea level will rise by 27 cm, which is 10.7 inches, because the ice will melt, regardless of what action we might take to prevent it. This is in addition to what we already knew might come during the rest of this century, more than doubling what was expected from Greenland ice. The article "Sea Levels Are Rising Along

the East Coast," on page 1 of this issue of Green Energy Times should give the reader an idea of what this amount of sea-level rise might mean.

The short story is that it can lead to a lot of damage to homes, to investments, and to the environment. It will speed up loss of land at the ocean's edge in many places, making some areas uninhabitable, and the people who live there will have to move to other parts of the country as climate refugees.

That includes some quite expensive buildings in some places, but it means that transportation and utilities would be threatened for other areas along the coast, rendering them uninhabitable even if they are not flooding. It also threatens such infrastructure as nuclear power plants and chemical factories along the coast with flooding. And it will turn some natural areas into places that are nothing like what they are today.

Sadly, this could have been stopped, if we had taken quick action in years gone by. But we did not. Nevertheless, we have to keep trying, because if we don't, it will certainly get much worse. ☹

Balance of Power

Janis Petzel, MD

Greenwashing, gaslighting, lying, cheating, criminality—whatever you call it, Big Oil has done it and is doing it still. Petroleum companies' internal documents in the 1970s recognized that fossil fuels would need to be eliminated to prevent serious climate disaster. Did they act responsibly with this information? We know they did not. But Big Oil did not do its dirty work alone.

Robinson Meyer in *The Atlantic* notes, Big Utilities also "sold climate half-truths and untruths to policy makers and the public."

In fact, since the 1970s after the Clean Air Act became law until today, malevolent hordes from the petroleum and utility industries, the coal-steel-rail sector, conservative think tanks, lobbying groups such as ALEC, and some religious-based groups have worked in concert, so they could continue to rake in money or to control seats of power. I'll call this unsavory group The Dirty Energy Sector.

There is hard evidence for what environmentalists have long observed: The Dirty Energy Sector will do anything to make money and stay in power, and they don't care who they hurt, maim or



By Leah Wittenberg. (leahwittenber.com)

cause to die an early death in the process. They've even started using punitive "strategic lawsuits against public participations" or SLAPP lawsuits to harass and silence protesters using the judicial system, all documented in a September 2022 report by EarthJustice.

Environmental Research Letters reports that dishonest tactics to delay action, sow doubt and deny climate science "allow[ed utilities] to invest in polluting infrastructure for several decades longer than scientists have advised is safe."

Because of the Dirty Energy Sector's

successful efforts to stymie, deceive, and sow doubt about climate change, global emissions of carbon dioxide were higher in the thirty years from 1990-2019 (872 Gt CO₂) than they were for the 240 years from 1775-1990 (804 Gt CO₂) despite environmental laws and rising availability of renewable energy.

You can see for yourself the geography of fossil fuel emissions in this recently released website by *Carbon Tracker and Global Energy Monitor*, <https://fossilfuelregistry.org/>.

The biggest polluters are the ones putting the most money into lying about

climate science. They are the most resistant to change. The top polluting utilities in the U.S. continue to invest in coal plants and in building natural gas-burning plants even though renewables are cheaper, to say nothing of contributing to politicians who do other bad things, like trying to overthrow democracy.

Climate denial seems so illogical to me. The big polluters may be addicted to money and power, but don't they breathe air or require clean water to drink? Don't these (mostly) men have children or grandchildren they care about? They act as if laws don't apply to them, but even the laws of physics? There's a disconnect.

Douglas Rushkoff wrote an illuminating article in *The Guardian* (Sept 4, 2022). He was invited to speak at what he thought was a conference on the future, but which turned out to be a handful of ultra-wealthy men prepping "apocalypse bunkers." They wanted his advice on how to keep their security guards from stealing their food or killing them. Rushkoff's advice—that the way to keep starving people from killing you is to make sure the community has food—was not of interest to these masters of the universe.

Why? They think they can buy their way out of the mess they have made. They know they are ruining the planet, but they won't stop because they have an out. Does this infuriate you as much as it does me?

But, as Maya K. van Rossum says in her book, *The Green Amendment* (see review in the next issue of *G.E.T.*) "Pollution and environmental destruction are not illegal in this country. People are allowed to pollute, damage and devastate the environment so long as they obtain government permits or licenses to do so."

That must change ASAP. We need

safeguards to correct the imbalances of power that allow these abuses to thrive. Van Rossum's Green Amendment to state constitutions is one such tool.

We need to get out the vote for candidates most likely to protect the environment and human health. Expanding rank choice voting may help to cut back on extremist candidates.

It's time to drive a stake through the hearts of these Dirty Energy Sector vampires in the only way they understand: Taxes—on fossil fuel-related pollution; value-added taxes on luxury items; wind-fall profit taxes.

In my dreams, all corporations are B corporations; they must legally put the environment ahead of shareholders' profits; Citizens' United is repealed; rules to bolster fairness cover cable and internet broadcasting.

Dreams are a start. But we need to do the work to restore balance so that rich, powerful people can't keep dumping their waste into our air and water and making us pay for it.

Vote, do what you can to protect the places you love, avoid buying fossil fuel products, support groups that can fight the legal battles, and demand better from our leaders.

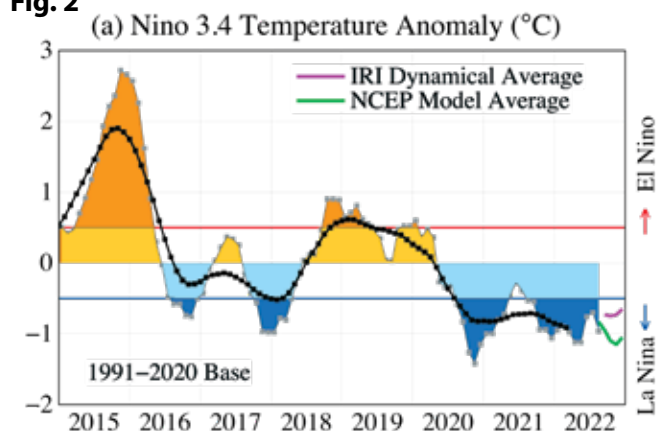
The Dirty Energy Sector broke the environment. They must bear responsibility to fix it.

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.

Source links provided in the online posting of this article at greenenergytimes.org. ♻️

BIDEN'S REPORT CARD – Cont'd from p19

Fig. 2



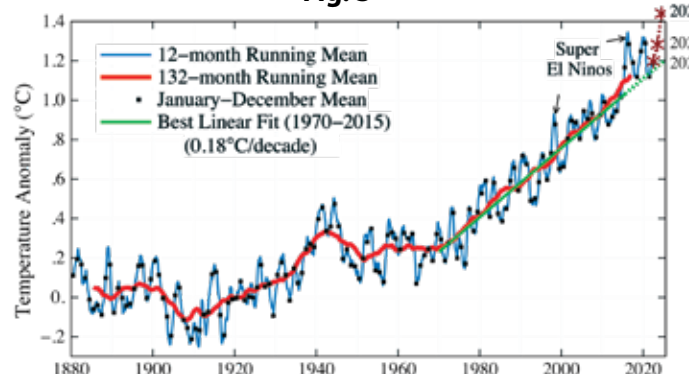
Lise Susteren was the star in our presentation to EPA. She put an hourglass on the table to emphasize that time was running out. She is a psychiatrist and psychologist, who, in describing the effect on young people of governments' ineffectual action on climate change, nearly brought tears to the eyes of her competitors. Still, although the EPA officials listened politely, we got few questions. On the way home, I marveled at the stark contrast with my first presentation to EPA, in 1982. John Hoffman took me to see Joe Cannon (Head of EPA's "Air" office) and John Topping. Busy, high-level officials, but we spent an hour with Cannon. Their enthusiasm for EPA to do something was overflowing. I soon had \$200K+ from EPA and a couple of then-modern computer

workstations to run our coarse-resolution climate model on. We provided data for Hoffman to write his infamous EPA report: "Can We Delay a Greenhouse Effect?" Hoffman was promptly slapped down by an anti-environmental U.S. administration and our EPA funding was soon down to zero.

Today we have a favorable administration in Washington, but do they understand what is needed to deal with climate change? EPA rejected our petition,[5] but there have been cases in the past when EPA rejected such petitions and then took up the work to see that the proposed actions actually happened. There are people in the administration who seem to understand what is needed and are supportive of our petition, so we can't put a grade on Biden's report card quite yet.

EPA has already used TSCA to phase down greenhouse gases (GHGs) that have no effect on ozone – they are simply GHGs that affect climate. This use of TSCA was upheld by the courts – the DC Circuit Court of Appeals in a ruling filed, notably, by Circuit Judge Brett Kavanaugh, now a Supreme Court Justice. The presumption

Fig. 3



that all conservatives are climate deniers determined to go down with the ship may not be well-founded. Sometimes the biggest chest-thumpers, those proclaiming to be heroes of the revolution, are actually its enemies. A good candidate for the Colonel Nicholson award is the New York Times and their description of the misnamed "Inflation Reduction Act" as if it were a climate savior. They had the gall to publish an article on August 9, 2022 that began, "Did the Democrats Just Save Civilization?" They really did it. The Inflation Reduction Act...about to become law.

The "Inflation Reduction Act" (quotation marks required) will add a bit to the downward trend in U.S. emissions and have of the order of 1% effect on global emissions, with the help of a huge loan that our children and grandchildren will need to repay. A rising carbon fee initiated under TSCA, in contrast, could be the beginning of the fundamental approach that is needed, an approach that most

economists agree could be made near-global via border tax adjustments. We have been fighting this battle with the *Times* for decades, but with their millions of readers and our meager thousands, it's a tough fight (these chapters,[6] written some time ago, are being revised – criticisms welcome).

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

Makiko Sato is a Ph.D. in Physics from Yeshiva University (1978). She started working in planetary science as the Voyager project at NASA Goddard Institute for Space Studies. Now she works for Climate Science, Awareness and Solutions, The Earth Institute, Columbia University.

Reto Ruedy obtained his Ph.D. in Mathematics at the University of Basel (Switzerland, 1968). After a one-year fellowship at Harvard University and teaching math courses at Columbia and Fordham University, he started working at the NASA Goddard Institute for Space Studies in 1976. He is involved in Climate Research developing the GISS Climate Model and using it to conduct various experiments.

Read more info and find source links at columbia.edu/~jeh1/. ♻️

I've always been a strong proponent of the combined use of solar PV and geothermal heat pumps to achieve residential zero net energy status. As I began to draft this article for Green Energy Times. It struck me that what better way to sing its praises than to provide a real-world example from a climate zone that experiences both hot, dry summers and snowy winters? I reached out to my good friend, Bill Martin in Quincy, California. I hope you enjoy his story.

— Joe Parsons, Senior Product Manager for ClimateMaster, Inc.

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GETTING TO CARBONLESS ZERO NET ENERGY IN THE SIERRAS

Bill Martin

I've now lived for 51 years at 3,500 feet in the northern Sierra Nevada. The challenges of heating (and more recently cooling) have been easiest since completing our last home in 2014 that I call the Quincy Zero Net Energy House. It has achieved "cost zero" for six out of its seven years of operation and "net zero" for three—meaning it consumed less power than it pushed back to the grid. Electricity from the sky and heat from under my feet has helped achieve my dream of thermal comfort on-the-cheap.

Our worst year came with 180% of normal rain and snowfall, costing us \$6.34 per month. We are all-electric, with a net energy metered intertie to the utility. Our 7.4 KW A/C solar array of 31 panels rests on our roof (at a 22.5° tilt from a 6/12 pitch). The utility is our battery, and we try to consume power off-peak when possible, because the rate is incentivized for that.

Higher expense is part of the rural mountain experience. I've heated with propane, kerosene, firewood, and for seven years with an air-source heat pump. Much of that was an increasingly painful challenge (especially fighting for firewood and getting-keeping it dry). We built a code-qualified home in 1998 that heated water and space with kerosene, but the



A 7.4kW rooftop solar array is installed on the author's all-electric house. (Photos: Bill Martin)

initial 90¢ price per gallon zoomed to \$4.78 by 2010. I had been a believer in heat pump technology since the mid-70s, so it was easy to understand the advantages of heat exchange from more stable temperatures underground. I also had enough construction experience (including solar since the 80s) to know I could design a very robust thermal envelope.

Our current home may be a somewhat

rare performer but rest assured, it's fully conventional without exotic equipment. The basic fundamentals still matter the most, and I kept those in mind because a great thermal envelope surrounding conditioned space means less heating and cooling needed. That means smaller equipment, costing less. And with geo heat pumps, it translates to less underground heat exchange piping, again

costing less. Put another way, not building with excessive windows and maximizing R-value cuts HVAC installation and operating costs. And if you're trying to include solar PV to reach for a certain level of performance—that means fewer panels. Strong envelopes provide multiple benefits!

Our walls are a double offset stud system on 16-inch centers on a two-by-eight plate. Thermal transfer inbound or outbound dies in the insulation and even where framing meets doors and windows, aligned studs still have a thermal break between their edges. Our ceiling, walls, and floor are R-49, 30, and 30. All windows equate to R-3.5 and our doors to R-6.5.

I like building with an attic space that's well-ventilated with low soffit intakes and continuous ridge venting. A spacious attic space like this buys time as does insulation—they both get you past the high highs and the low lows until the outside air improves. After hot days when my attic thermistor reads 130°F, it drops to be equal to outside ambient by sunrise. I benefit from a naturally dry environment that helps, particularly on clear nights.

One always sizes HVAC equipment by the dominant load. Mine is heating, and although our ASHRAE winter design temperature is now only rarely achieved

Cont'd on p.29

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WHAT IS A MINI-SPLIT HEAT PUMP?

Allison Bailes

Ah, mini-splits. They're all the rage in the world of high-performance HVAC. But what exactly is a mini-split heat pump? Unfortunately, the terminology around this technology is confusing because it's used so inconsistently. Let's start at the beginning. (Well, OK, not all the way at the beginning. I'm not going to explain what a heat pump is, but a primer on how they work for heating can be found at <https://bit.ly/3ertdo1>)

The basic meaning

The term "mini-split" itself originally referred to a split system heat pump (could also be an air conditioner) with a smaller capacity than conventional systems. In that sense, a mini-split is just what its name says it is: a small split system heat pump. Where it gets confusing is in the different ways manufacturers make these lower-capacity, split-system heat pumps.

A mini-split, for example, can have a conventional fixed-capacity compressor or an inverter-driven variable capacity compressor. So, a mini-split could be a conventional heat pump that's just smaller. Or, it could be a smaller heat pump with variable capacity. The former type is rare, though, so when you hear the term "mini-split," you should think of the type with the inverter-driven compressor with variable capacity.

But it gets worse. This type of heating and cooling system has outgrown its name, at least the "mini" part. Yes, you can still get them down to a half ton of capacity (6,000 BTU per hour), with smaller capacities on the way. But you can also get mini-splits that have a capacity of four tons (48,000 BTU per hour), which is far from "mini."



The wall-mounted ductless mini-split heat pump in my sunroom. This is the only indoor unit connected to the outdoor unit, making it a one-to-one setup. (Courtesy photos)

Is it a mini-split or a multi-split?

Another confusing area is that with this type of heat pump, the outdoor unit can be connected to one indoor unit (referred to as one-to-one), or it could be connected to multiple indoor units. Some people distinguish these two types by using the term "mini-split" only for the one-to-one configuration. When you have more than one indoor unit on a single outdoor unit, that's a multi-split heat pump.

If we go with that dividing line, I have both a mini-split and a multi-split in my house. The main part of the house is heated and cooled with one outdoor unit connected to two indoor ducted air handlers. That would make it a multi-split. And I use a one-to-one ductless system for my sunroom.

Are all mini-splits ductless?

And then there's the issue of the type of indoor unit. Some are ductless, and

they come in different types: wall-mounted, ceiling cassettes, and floor-mounted. Others are ducted, and they come in horizontal ducted or multi-position types. Some people use the term "mini-split" only for ductless indoor units. Others refer to any type of split system with smaller capacity as a mini-split, no matter whether the indoor unit is ducted or ductless.



One of the ducted air handlers for the mini-split heat pump being installed in my house in 2019.

I use the term "mini-split" for all of the above. Since mini-splits with fixed-capacity compressors are rare, you don't really need to worry about that confusion. If you're talking to someone about mini-splits, you should be able to tell from the context how they use the term. If not, ask them to clarify.

Inverter-driven mini-split heat pumps

Inverter-driven mini-split heat pumps are the future for high-performance homes. I've got them in my home, and it's what we specify in a majority of our HVAC

design jobs at Energy Vanguard. Their high efficiency and variable capacity that can ramp down to very low values are perfect for super insulated, airtight homes. And they work well in less efficient homes, too.

They give you a couple of other benefits as well. Their lower capacity means you can zone your heating and cooling with separate pieces of equipment. And using separate pieces of equipment provides resilience. If one heat pump stops working, you can still heat or cool the parts of the house that have operable equipment.

One final point concerns the one-to-one configuration. If you want the highest efficiency, the best zone-to-zone control, and the most resilience, use only one indoor unit on each outdoor unit. Multi-split systems can work fine, but they're just not as good as one-to-one setups.

Reprinted with permission from Energy Vanguard's blog post at <https://www.energyvanguard.com/blog/what-is-a-mini-split-heat-pump/>

Allison A. Bailes III, PhD is a speaker, writer, building science consultant, and the founder of Energy Vanguard in Decatur, Georgia. He has a doctorate in physics and writes the Energy Vanguard Blog. He is the author of A House Needs to Breathe...Or Does It? ♻️



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NEW FEDERAL TAX CREDITS AND STATE REBATES TO HELP PAY FOR HOME HEATING, EFFICIENCY, AND WEATHERIZATION IMPROVEMENTS

Michael Daley

The Inflation Reduction Act (IRA) does not just provide a boatload of new money to help you be more comfortable in your home while helping to save planet Earth, it provides a whole convoy of boatloads! That money is flowing in two channels – as federal tax credits that will offset money you owe to Uncle Sam and as direct rebates administered at the state level to offset the costs of all kinds of home heating, efficiency and weatherization projects.

The expanded rebate incentives are especially good news for low- and middle-income homeowners who often have not benefited from the kinds of tax credits used in the past. The IRA covers 100% of the costs of certain upgrades (up to \$14,000) for low-income homeowners and 50% of the costs for middle-income ones. Each state will be setting the rules for their programs. Rewiring America provides a useful calculator on what individual households can expect: <https://www.rewiringamerica.org/app/ira-calculator>.

One thing to keep in mind as you contemplate what the IRA may offer to improve your own home. Where there is a sudden pot of gold, there will be gold diggers. Be sure that you connect with reputable service providers and consultants that have the experience and track record to get the job done right. Energy projects done wrong won't get you, the planet, or Uncle Sam their money's worth.

You have the pages of *G.E.T.* to rely on and definitely reach out to your local community action agency or others that do weatherization. They likely know and work with your local contractors.

There are three major elements to the IRA for homeowners:

1. The 25C Energy Efficiency Home Improvement tax credit
2. The High-Efficiency Electric Home Rebate (HEEHR) Program
3. The HOMES Rebate Program

Be aware that **the HEEHR program and HOMES rebates cannot be combined** with one another; however, either may be combined with the 25C tax credit.



(AdobeStock_524296929/Formatoriginal)

The 25C Energy Efficiency Home Improvement tax credit

This home improvement tax credit has been around for a while, but starting in 2023 the IRA increases the value of the tax credit to 30% and makes it possible for you to receive a benefit each year. The value of the tax credit is annually capped at the following:

- \$2,000 for electric and gas heat pumps and heat pump water heaters, biomass stoves, and boilers
- \$1,200 for weatherization and electrical panel upgrades that are in many cases required for qualified energy-efficiency upgrades

Don't forget that tax credits already exist for projects you have underway in 2022. The IRA provides some additional support to these soon to end credits.

High-Efficiency Electric Home Rebate (HEEHR) Program

The IRA creates a new **\$4.275 billion program called the High-Efficiency Electric Home Rebate (HEEHR) program**. Funding flows from the Department of Energy to your state energy office. Each state will be responsible for setting up its HEEHR program aimed at providing rebates to households with a total annual income that's less than 150% of the local median income. The local median income for your area will be defined and determined by your state.

The maximum rebate is \$14,000.

The program's maximum rebate values include:

- \$2500 for electric wiring
- \$8000 for heat pumps,
- \$1600 for air sealing and insulation
- \$4000 for breaker box upgrades to allow for increased use of electricity.
- \$840 toward electric stove
- \$840 toward heat pump dryer

- \$1750 for heat pump water heater

The IRA creates a second brand-new \$4.3 billion program called the Home Energy Performance-Based, Whole-House rebate program (HOMES). The HOMES rebate program will also be overseen by your state's energy office. HOMES incentives aren't restricted by income and are based on the actual performance of your whole-home energy efficiency and electrification improvements.

These performance-based market incentives aren't paid to the home-owner, but to the contractors, installers, or home performance companies that do the work. The rationale behind this is to encourage businesses doing home energy improvements to complete high-quality installations, maximize energy savings, and

ensure the project performs as promised. According to SEALED, HOMES will lead to **"...better projects, more comfortable, healthier [sic] homes, and guaranteed performance."**

When can I tap into these new programs?

Extended or enhanced tax credits are available for projects beginning this year. The new higher tax credit begins in 2023. Check with your contractor and tax adviser to see if you qualify.

Funds begin to go to the states in 2023. Each state will have to define and adopt rules, provide authorizations, increase staff, etc. to get these programs up and running. All this is expected to take up to a year or more. As always, you can count on *G.E.T.* to summarize in each issue what becomes available in your State. ♻️

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INTERVIEW WITH HARRY LUX

G.E.T. Staff

G.E.T.: What is your title, role and how did you get started in this industry?

Harry Lux: I am the owner of Black Magic Chimney Sweeps located in Manchester Center, VT. I have owned this business since 2009.

This business has a long tradition of serving customers in southern Vermont and eastern New York. It was started in the early 1980s by Jim Harkins who saw the power of wood burning, alternative heat. He sold to Brian Shult who ran it from around 2002 to 2009 when I took over. When I took over, we expanded on the passion for serving customers and helping them stay warm and happy by heating with wood in their homes. Our company has grown to include not only servicing wood burning fireplaces, stoves and inserts, but we sell and install them, too. Our team also helps our customers with masonry repairs to their chimneys to protect their families and their investment.

We serve between 2500 and 3500 customers a year with jobs ranging from sweeping a flue to replacing whole systems, chimneys, and fireplaces. I believe the things that make us unique are our commitment to customer service and education.

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



Black Magic Chimney Sweeps team. (Courtesy photo).

HL: The concept of chimney sweeping is simple. Run a brush up (or down) the chimney and clean up the mess a few times a year and the chimney is ready to burn a few more cords of firewood. This is generally true. The trouble that we see is that there are hidden conditions that can either affect the performance and efficiency of the stove, or it is a hazard waiting to become someone's bad day. The hazards can be either defects that have occurred over time and go unobserved by the untrained sweeper, or they can be issues that a well-meaning person installing the stove did not fully understand such as clearances to combustibles. When we work on any appliance, we make sure the unit was not only installed properly, but that it is functioning as the manufacturer designed. To

do that, we will use our experience, the NFPA (National Fire Protection Agency) standards, manufacturer's installation instructions, and our high-tech equipment such as expensive high-resolution, color cameras which allow custom-

ers to see the inside of their chimney flues with great clarity. By taking the time to do this kind of inspection, our customers can be assured that their unit will operate as safely and efficiently as possible.

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

HL: The current federal tax credit program gives homeowners a 26% reduction in the cost to improve efficiency with a wood or pellet burning stove or insert in their homes. Many customers have inefficient units that are older and waste money, time, and fuel which adds to the carbon footprint. Many new stove and inserts qualify for the tax credit and the Efficiency Vermont rebates making

it an even easier decision to invest now and save for decades into the future.

What in your field of specialty is most valuable (related to energy efficiency or the EEN) that our readers ought to know about?

HL: In the chimney services industry, I believe it is most important to have certified chimney technicians service your home. They care about their education and want to stay abreast of changes in the trade. For example, all of our technicians have a national certification, many have multiple certifications, and we are the only company in Vermont and upstate New York who has two CSIA Master Chimney Sweeps. This commitment to education has moved our team into the field of pressure diagnostics using many of the same tools as BPI certified energy auditors like blower doors and digital manometers.

Why should people use an EEN member over someone else?

HL: Customers using an EEN contractor or service provider will get someone who is passionate about their craft, who is able and willing to communicate the benefits of different decisions, and who is confident in the benefits of saving energy, reducing the carbon footprint, and saving money over the long run. They are visionaries and share your commitment to make things better for all. ♻️



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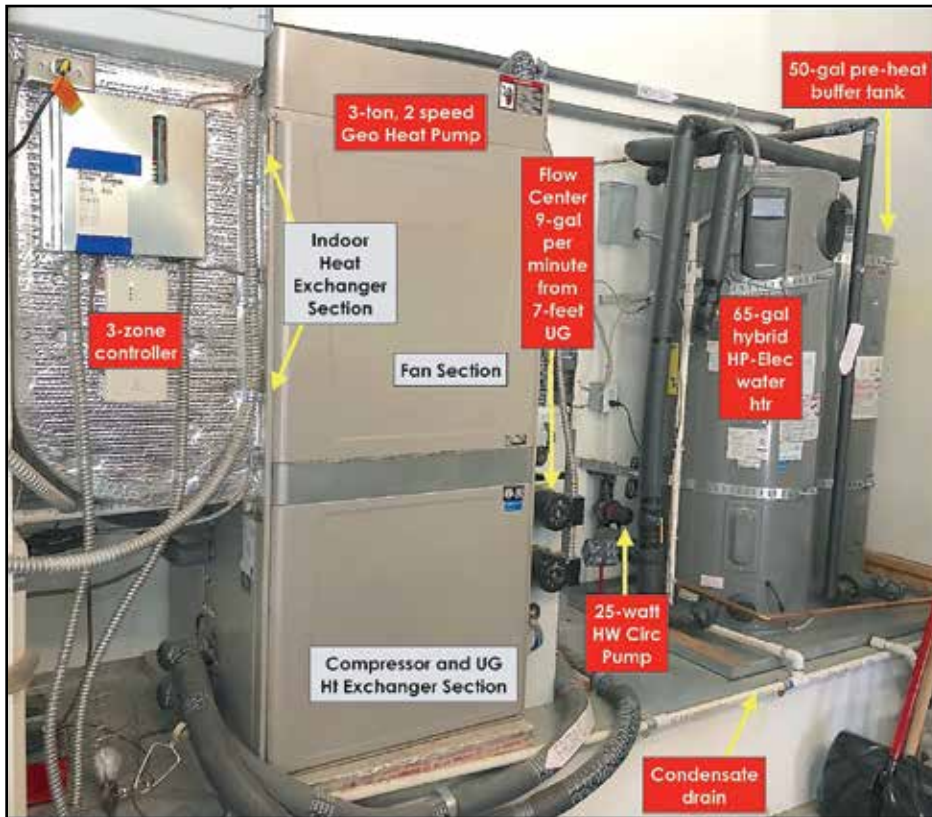
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ZERO NET ENERGY IN THE SIERRAS

Cont'd from p.24



The geo heat pump and hot water set-up which saves energy and money in the author's carbonless zero-net-energy home. (Bill Martin)

(+10°F) our house should lose no more than 18,000 Btu per hour at that temperature. I chose a three-ton, two-speed geo heat pump because at low output and incoming loop water at close to 40°F, I would receive 22,000 Btu per hour, some of which is diverted to hot water pre-heat. Even with two circulating ground loop pumps, my total electric consumption on low speed is 1,750 watts (and as I like to say—less than Susie's hairdryer).

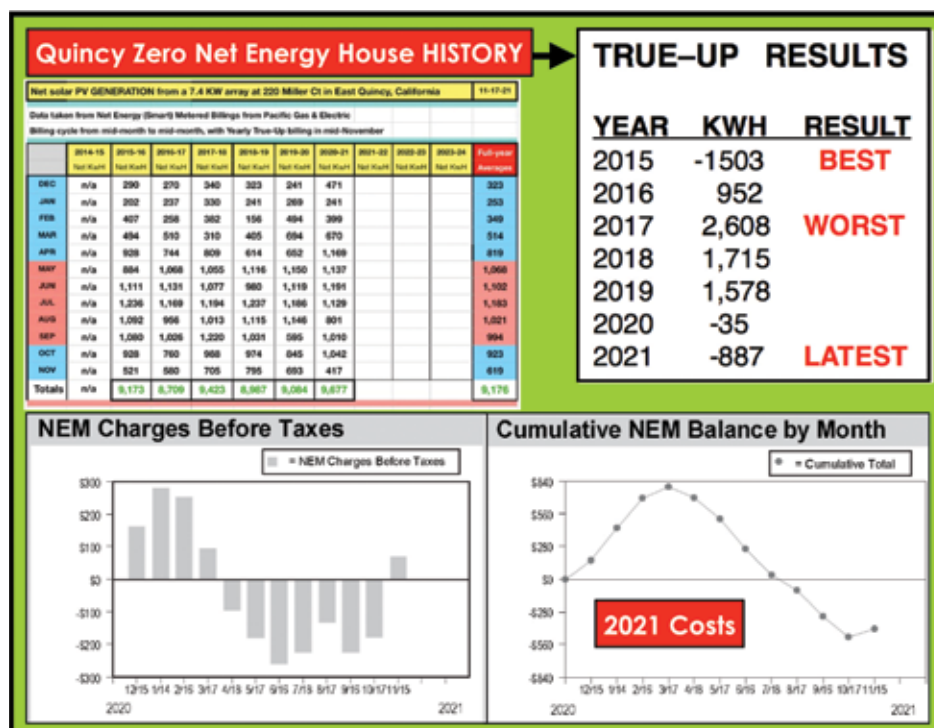
My attached garage contains our HVAC equipment in an 1,800 square foot space with good insulation and insulated doors. It is a good buffer against outside winter temperatures and has never dropped below 49°F. I chose a water-to-air heat pump for filtering the air (electronically) dehumidify it in summer (condensate removal) and humidify it in winter (with electric-steam) for a relative humidity of 43%. Our thermostats are set to 69° and we're still comfortable.

The mechanical area also has a heat recovery ventilator into our duct system and a 50-gallon tank for hot water pre-heat, ahead of a 65-gallon air source hp water heater driving a circulating loop. Our heat pump delivers only 850 cfm at low speed, so three zoned thermostats serve inside space to keep air velocity up.

A geo heat pump doesn't struggle when outside air is hottest or coldest because it has a steady thermal battery underground. In 104°F summer heat, my heat exchanger rejects heat to dirt that is 41.5°F cooler. Winter nights at 22°F concentrate heat from 50°F dirt (28°F warmer).

A more detailed white paper on this project is available at <https://bit.ly/californiageo-QuincyZNEPerformance>.

Bill Martin is an IGSHPA-certified ground source heat pump installer and currently serves as president of CaliforniaGeo. ☻



Charts showing the energy usage and cost savings of the Quincy Zero Net Energy House which utilizes a geo heat pump and solar. (Bill Martin)

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WARM AND COOL HOMES #4

The (Green) House That Jack Built

Wes Golomb

Jack Bingham's house is a direct result of the research he conducted at the University of New Hampshire on how heat pumps can make greenhouses usable in the winter. Most greenhouses are either shut down in winter or are inefficiently heated with fossil fuels to keep them going in cold weather. Despite the cold, on a sunny day in February the temperatures in a greenhouse can rise to the high 90°F range.

Jack's research centered on installing heat pumps to remove heat from his greenhouse and store it in insulated water tanks.

There was one problem, however. Because glass is such a poor insulator, the greenhouses ran out of heat by 3 a.m. That got Jack thinking. Suppose he built a greenhouse attached to a very well-insulated and air-sealed home. He could capture the heat with a heat pump and store it in a water tank to heat his house. And that is what he did! Jack designed a house with a greenhouse on the front, a heat pump, and a storage tank.

An abundance of boulders made it cost prohibitive to build a basement, so an Alaskan Slab, also known as a floating slab was used. The entire foundation is wrapped by foam insulation.

The walls are constructed of structural insulated panels (SIPs) produced by Foard Panel in West Chesterfield, NH. The SIPs are made of foam insulation sandwiched between two pieces of oriented-strand board (OSB). They are made in eight-foot-wide panels and splined together. Laminated in a vacuum press, together they become an impermeable structural component that offers continuous insulation and greatly limits the conductive heat loss experienced in most typically framed houses.

In standard framed houses, the electric wiring runs through the walls. This often compacts the insulation, making it less ef-



Jack Bingham's house in Barrington, NH; heat pump on second floor of the greenhouse (Jack Bingham)

fective. To avoid this, the inside of the SIPs is strapped with 2x4's, which allows space for wiring.

The design challenge in this house was to keep the heat in rather than letting it escape. To achieve this, the greenhouse walls, like the rest of the house, were well insulated and air-sealed.

At \$50,000, double-paned glass was cost-prohibitive, so Jack looked into other materials. There are two factors to evaluate when installing glazing—how much light the glazing will let through (its emissivity) and how much heat the glazing will let out (its conduction). These two factors are inverses. With thicker material, the insulation is better but less light gets in. With thinner material, more light gets in but more heat gets out. Jack chose the middle option—a three-quarter inch triple-walled polycarbonate.

One of the key features of this design is a means for storing heat after it is collected



from the greenhouse. This is accomplished by installing an 800-gallon tank buried under the floor of the greenhouse. The storage tank is contained within a wooden crate made from pressure-treated wood. The tank is insulated to R-28 on the sides and bottom,

and R-40 on top. As a result, the hot water stored in the tank holds its heat for a very long time.

The greenhouse is specifically designed to capture the sun's heat and store it for use at a later time. The mechanism used to accomplish this is two air-to-water heat pumps installed on the second floor of the greenhouse. Using the same concepts as an air conditioner, the heat pump takes heat from the air in the greenhouse and transfers it to water via a heat exchanger and refrigerant.

On a sunny winter day, it is common to find the greenhouse's temperature at 90°F or higher. At this temperature, heat pumps are extremely efficient. Jack calculated that

for each unit of electricity used by the heat pump, it generated a heat equivalent of up to eight units of electricity! What an incredible ratio: an input of one unit of energy (electricity) produces an output of eight units of energy (heat)! It seems like magic, but it's physics.

When the average person's energy consumption is calculated, a car is the second largest energy consumer after a home. Jack's net-zero home is designed to generate enough energy to run the family's Nissan LEAF all-electric car in addition to the home.

In the first years of occupancy with 9.5 kW of solar installed, the cost of electricity was under \$500 a year which included charging a car. Last year Jack added 4.6 kW of PV and a second heat pump.

The system is net-metered, so when the solar array produces more energy than is needed, the excess is put back onto the grid. This runs the meter backwards and builds a credit so no on-site battery storage is required.

With the added solar and second heat pump, Jack expects this house to be net-zero and may possibly be net-positive, (generating more electricity than it uses) this year.

Jack's house is indeed one of the most unusual I have investigated. The synergy created by the tight envelope, extremely efficient heating system, and photovoltaic array provides all the needed electricity to power the house and car.

We energy geeks tend to focus on cool technologies and design but perhaps what is most impressive is that Jack's wife, after long suffering with asthma, has had no attacks since they moved in. This is an excellent example of the power of these technologies to allow us to live in a comfortable, healthy and resilient way without generating pollution.

Wes Golomb is a long-time clean energy and climate advocate from Deerfield, NH. Wes is the author of the Warm and Cool Homes book and videos. ♻️

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WASHINGTON ON THE VERGE OF "CLEANEST HOMES IN THE NATION"

Alejandra Mejia
Cunningham

The State of Washington continues to take bold steps toward clean and healthy new buildings this year. After adopting a requirement that all new commercial buildings must use high efficiency space and water heating equipment that can run on 100% clean power, the State Building Code Council is poised to extend similar requirements to new residential buildings. Once this policy is adopted, every new home built in Washington starting in 2023 will have the capabilities to maintain comfortable temperatures year-round affordably and without burning harmful fossil fuels on-site.

Why Do Buildings Matter?

More than 10% of the fossil fuels used in Washington are burned directly inside homes and buildings. Not only are these fossil fuels a significant source of climate-warming pollution, but when we cook on gas stoves or when our gas furnaces and water heaters are improperly vented—they threaten the health of our families. Children who live in a home with a gas stove have a higher risk of experiencing current asthma symptoms, found a peer reviewed study published in the Journal of Epidemiology.

There are free and low-cost things you can do today to reduce the risks from this fossil fuel pollution inside our homes. For



Seattle Washington's skyline and Space Needle (Dilu via Wikipedia)

example, using a properly installed vent hood or opening kitchen windows while cooking can really reduce the amount of toxic air pollution from cooking with gas. Another option is to purchase an inexpensive plug-in induction burner to do some of the cooking (e.g. to quickly boil water) without having to turn on the gas burners.

But these individual actions will only get us so far. We need policy to help everyone eliminate the pollution harming our families, communities, and climate. This is where Washington's proposed code for new residential buildings comes in.

How Does the Proposed Washington Policy Help Fix the Problem?

The proposed building code increases ventilation requirements for gas stoves. It also requires that all space heating be provided by ultra-efficient electric heat pump systems that can run on 100% clean power


(with limited exceptions for electric resistance and fossil fuel back up in very cold climates). Finally, it requires that all single and two-family homes and townhomes be outfitted with similarly efficient and clean heat pump water heating systems.

These requirements will only apply to new homes, where building all-electric from the start is already more affordable and results in lower energy bills far into the future. Alterations and heating equipment replacements in existing homes will not be affected. We know that burning fossil fuels in homes harms our climate and our health and safety, and that we must transition to cleaner and more affordable energy sources for every building in the state—including new and existing homes. We also know that retrofitting existing homes is a more involved process that will require different kinds of policy support to ensure everyone benefits from the transition to cleaner homes.

Together with a similar policy that was overwhelmingly approved for commercial buildings earlier this year, this new residential code would ensure that virtually all buildings constructed in Washington as of January 1st, 2023 are ready to meet the state's ambitious but necessary building decarbonization goals. The first step of getting out of a hole is to stop digging. These new codes do just that for climate-warming emissions from buildings in Washington. We can now turn to reducing emissions from all the other buildings that are already standing.

Alejandra Mejia Cunningham works at the NRDC (Natural Resources Defense Council) as

an expert for the Building Decarbonization Advocate, Climate and Clean Energy Program

Republished with permission from NRDC's blog on September 29, 2022 (<https://www.nrdc.org/experts/alejandra-meja-cunningham/washington-verge-cleanest-homes-nation>). 



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THE PUTNEY SCHOOL IS AT IT AGAIN!

Barb and Greg Whitchurch



The front page of Green Energy Times, May 2010, featured the Net-zero Putney Fieldhouse. Read this edition at greenenergytimes.org/back-issues-download/.

Twelve years ago, *Green Energy Times* (May 4, 2010) reported on an innovative building project in southern Vermont at The Putney School, a private residential high school. They built a net-zero field house for their sports programs, designed by Maclay Architects (www.bit.ly/get-542010).

Now, the Putney School is beginning another major project: a pair of combined faculty housing and student dormitories. The principles and players described below are already well-known and have a proven track record.

Once again, the architects are Bill Maclay and his seasoned team at MaclayArchitects.com. Bill is a widely-traveled presenter and sought-after resource (www.bit.ly/aia-vt-fellows). He is a leader among architects using modern building science principles and sustainable building practices, and the

author of *The New Net Zero* (www.bit.ly/get-bm-nnz).

The construction company is ReArch Company of South Burlington, VT (bit.ly/rearch-sus), itself a company with a long history of high performance and net-zero construction, e.g. www.bit.do/get-tph2 and the Passive House certified bit.ly/get-elm-place. ReArch works toward "improving lives through the built environment" and focuses on all aspects of healthy, sustainable design.



Rendering of Putney School's new faculty housing and student dormitories. (Maclay Architects)

Maclay has chosen Andy Shapiro of Energy Balance to oversee the construction and integrity of the building envelope. Andy is himself a widely-recognized expert and educator on issues

related to applying building science and energy efficiency principles to high-performance enclosures of all types.

We attended a pre-construction meeting on September 14th at the school with the major members of the team.

Andy Shapiro conducted this meeting, wherein he reinforced the need for tight integration of all parties throughout the project: from preparing the foundation underlayment through to the roof ridge cap, from intermediate blower door testing through final commissioning of all building systems, all leading to handing the keys over to the school one year from now.

Shapiro described the documentation software and procedures for flagging problems, developing solutions, and verifying the fixes. He described his position as "Umpire and Field Judge," overseeing details of every imaginable magnitude. He will verify the final blower door reading: target 1,418 CFM at 50 pascals. After occupancy, the ongoing energy monitoring will disclose the high-performing and net-zero results required for final certification.

With the Putney School, Maclay Architects has developed a "net-zero energy master plan" for the whole campus and will provide ongoing proof when it has done so. As Andy pointed out, these will be state-of-the-art buildings with very low energy use and will be net-zero once the overall campus PV system is enlarged. The campus currently has 500kW of solar PV; and, over time, will add another 1,000kW to provide electricity for the existing buildings and the two dormitories.

When Andy is not directly available, continuity will be provided by his assistant for this project, Jacob Deva Racusin of NewFrameworks.com, a respected energy and sustainable materials expert, builder, and presenter in his own right.

ReArch Company has selected subcontractors who have proven

Cont'd on p.33





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**Winooski School District
Largest Net-Metered Solar Energy Project In Vermont**

IMPROVING LIVES THROUGH THE BUILT ENVIRONMENT

<< Cont'd from p. 32

themselves capable of such a project. Representatives of all these companies were in attendance.

- Envelope air sealing and moisture control: NicomCoatings.com/
- Insulation: MurphysCellTech.com
- Electrical: LLElectricServices.com
- Roofing: IronHorseVT.com
- Mechanicals: EngineeringVermont.com will engineer and haydenph.biz will install mechanical systems. A lot more will be said in the next article about the fossil fuel-free choices (fossil

fuels are more expensive, unsafe and unnecessary). Solar thermal hot water, too!

You would be impressed at the level of detail that is discussed at such a meeting. All materials (foundation through roof, membranes, tapes, caulks, insulation, fasteners, etc.) and suggested alternatives are considered (e.g. a 25% or greater slag concrete for the foundation to reduce its carbon footprint).

In addition, every type of envelope penetration and its repair is discussed in detail: who makes the hole, who

repairs it, who's responsible for certifying the finished detail and how that is recorded. Wherever two materials touch (tape on a membrane, caulk on concrete, etc.) how is their compatibility measured, who certifies that compatibility, who enters the information in the tracking



Solar array at Putney School shows its focus on sustainability. (Flickr/Putney School)

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system? The "issues log" is the tool for assemblers to announce, track, discuss, address each little "surprise difficulty," and sign off on its completion.

Then the participants moved on to discuss the sequencing of tasks. For example, intermediate blower door testing has been scheduled. During the meeting we were treated to a demonstration of theatrical fog, which is used to confirm the air barrier continuity. Finally, participants discussed how to deal with intermediate weather and UV

exposure of materials that will be protected eventually: selecting materials with verified exposure ratings specific to this project's timing.

This is the first in a series about the Putney School dorm project: demonstrating the future of high-performance building in Vermont and elsewhere.

Find article links on GET's website.

The Whitchurches use induction cooking in their net-zero+ Middlesex, VT Passive House (www.bit.ly/vtph-phc). For related articles: www.bit.ly/get-w-build

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Vermont Tech Renewable Energy Students MAKE CONNECTIONS TO INDUSTRY

Daniel Costin

The renewable energy program at Vermont Tech was founded in 2014 with industry collaboration. Funding was provided by the Blittersdorf Family Foundation. Our advisory board was made up of representatives from renewable energy companies such as SunCommon, SunWood Biomass, AllEarth Renewables, and Norwich Solar. These advisory board members have helped to keep the curriculum relevant to the fast-changing renewable field. The curriculum is about the engineering of renewable energy systems. It teaches the students how to design, analyze, and build systems. Many of the companies on our advisory board have hired our graduates and also provided summer jobs for our students. These students are prepared for summer jobs by taking classes in mechanical, architectural, and electrical engineering, solar PV, hydro, building science, and wind energy. They get to put their skills to work on the job and learn new skills, too. Once they come back to class in the fall, they write about their experiences. Here are some excerpts.

What I was trying to achieve during my time at Solaflect was to become more of an independent worker than when I had started, while also learning a little more about the solar industry. I definitely ended up achieving both of these goals. I started off needing validation from my superiors that my work was good enough, but by the end, I was leading jobs while teaching other interns. – Henry Pentland

Work at Wanzek Construction related to the classroom topics that we went over in the solar PV class with our teacher Will White, such as adjusting azimuth angles, panel/inverter wiring as well as shading. Problem-solving at school helped as I had to be quick on

my feet to adapt and learn as needed to be successful and talk about my work confidently. The hands-on approach that we take in every class at Vermont Tech also helped. Overall this was one of the best experiences of my life.

– Thomas Ferguson

New connections to industry are being



Henry Pentland, student at Vermont Tech, levels the pedestal bolts for a solar PV tracker system as part of his summer work experience at Solaflect Energy. (Henry Pentland)

added to the curriculum. Vermont Tech graduate Bret Benner of AllEarth Renewables assisted us with the maintenance of our 100 ft anemometer tower. With his help, we were able to lower the tower and the students replaced aging instruments. Our students will soon be visiting Green Mountain Power's hydroelectric facility on the Little River in Waterbury, VT. Preston Gregory, another Vermont Tech graduate, is organizing that tour. The students use the computer program Matlab/Simulink to study the control of hydroelectric and

other types of rotating generation. This trip is an opportunity to see the control of hydro turbines happening in real time. Also, Norwich Technologies is developing a 2.2 MW solar site in Barre with workforce training in mind. They will construct this site with features to provide a convenient location for construction and operation and maintenance training. Our existing solar PV class covers construction, but as more solar sites are installed, careers in operation and maintenance of those sites become more likely. And as the climate crisis becomes more urgent, so does the need for renewable technologies like the heat pump and wind turbine donated by

AllEarth Renewables.

At Vermont Tech, we are extremely grateful to our industry supporters. It is a great relationship that helps our students learn, and helps to train workers for the renewable industry in Vermont and New Hampshire. Demand for our graduates is very strong, and we hope to keep producing well-trained graduates.

Daniel Costin is Program Chair, Renewable Energy, Vermont Technical College. ♻️

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David Fried

Why does it feel so good when someone gives you flowers? They are so small and light but they are so important.

You are walking along a forest path and all of a sudden you see a flower. Or a mushroom. Or a chipmunk. Unexpected delight. Shakes me out of my mind, and I start breathing deeper and seeing the glorious life and light all around me.

We serious vegetable and fruit growers are planting food plants. It

is so easy to plan a garden of carrots and tomatoes, peas and lettuce. Straight rows in raised beds all neatly growing. Sowing, hoeing, mowing and growing. With a row of raspberries and blueberries nearby, just enough for the family.

With flowers we get carried away. There is no limit, no straight lines. They are indiscriminate and indescribable in the way they dance in the wind. When a person is



(Painting by Gabriel Tempesta)

coming into their true self we say "they are flowering."

Lately, when I design gardens and fruit groves for people, I have been suggesting planting some flowering shrubs and trees. I have discovered them later in life than the other stuff.

Witch hazel is a Vermont native that thrives in some shade and gives a dazzling show of golden confetti in autumn when there are few other plants flowering at all.

Jerusalem artichoke blossoms arrive in late September and light up the hill here. I have been bringing people over to smell them. There is a hint of chocolate aroma in this native Vermont plant!

Elderberry blossoms can be made into fritters. You can also make a tea or even a liqueur from these native flowers. Or you can just enjoy their soft cloudlike look and watch them slowly become purple berries

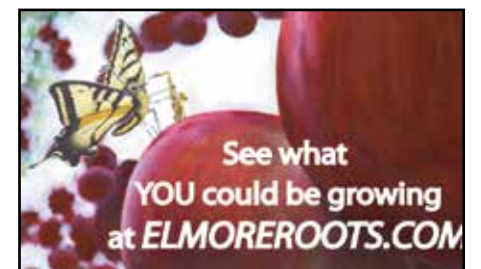
with a strong healing quality when gently heated into a syrup or elixir.

Hazelbert blossoms arrive in spring-time, but you have to look hard for them. The male flowers hang down brown and are called "catkins." The female flowers are nearby. They are magenta pink when open and look like very little stars in spring, to be pollinated into hazelnuts.

Flowering raspberries (*rubus odoratus*) have maple-like leaves, large rose-colored blossoms and nearly flat cotton-candy like dried raspberries that you gently lift off the plant to eat. It can grow in some shade.

Clove currants blossom two months or so before the fruit is ripe. These flowers are bright yellow and smell like cloves. I want to know where a plant gets its aroma from? Was it already in its seed? Did it mix with something in the air?

Come to think of it, where do flowers really come from? How does the large red or yellow blossom come from a small plant which grew from a tiny seed? Even if you tell me, it was all folded up inside the greenery, and the seed sprouted and



then grew, I still want to know where it gets its delicious smell from!

I am planting a lot more flowers these days for no reason at all. I look forward to seeing them. Annuals have the most stunning blossoms. This year I grew a few I cannot pronounce and also some nicotiana and an amaranth called "love lies bleeding." The first is fragrant and the next is daring. Sometimes I wear a flower in my hat or over one ear.

What if every time we were upset about something we found a flower to visit for a few minutes? There is something so calming about them. They are wise beyond their years. In each delicate flower is a lot of hope for the future. Did you know that every vanilla bean and cocoa pod and each apple you eat began its career as a flower?

David Fried of Elmore Roots Nursery, playfully writing about flowers and fruits and life. ♻️



Love lies bleeding flowers (David Fried)

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-](https://groups.google.com/group/fossil-fuel-freedom)

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

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

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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MESSAGE TO SAVE THE PLANET

Message to New England airport management: don't delay, open solar energy schools and or solar energy installation schools on your airport grounds, also businesses could paint their rooftops white to save energy and cool the surrounding areas. David Fisher Pittsburgh, PA • davidpfisher24@gmail.com.

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Larry Plesent

Ingredient of the Month Living in an Estrogenic World

Previous Ingredient of the Month articles have focused on various plastics and their effects on human health. Let's take a deeper dive into the plastic-coated world we have created for ourselves, and its real-life implications. What you are about to read is happening now to your body and to people you love. This is not taking place in some theoretical future.

Here's a good rule of thumb told to me by the CEO of a cancer drug testing company with offices in multiple states. She told me that the clearer and more flexible the plastic, the more it leaches phthalates or bis-phenol A (BPA) into whatever it contacts. In her own words, "If it smells or tastes like plastic, you are being poisoned."

Heating and cooling plastics increases the release of off gassing and leaching chemicals used in the creation of the plastic object. For example, freezing water bottles creates microcracks in the plastic which greatly increase chemical leaching from the bottle.

Reusing your plastic water bottles turns out to be a terrible idea. Not only are you being chemically poisoned by the bottles, the porosity of polyethylene terephthalate (PET) plastics also allows bacteria and



Chemicals from plastics can leach into the drink or food it holds, especially when the plastic is heated or cooled. (Flickr/Steven Depolo)

germs to proliferate on them. Not good.

PET or PETE (#1) plastic is the type of plastic infamously used to make most water bottles. You will find it in tin cans as an inner surface coating, car interiors, medical tubes, furniture, and disposable medical devices. Phthalates are assimilated through the skin, drink and food, baby toys, pesticides in our food, work and homes; and by breathing a near-constant stream of plastic dust from degrading clothing and tires. Your body perceives and assimilates phthalates as if they were estradiol, the most biologically active

form of estrogen.

Estrogen supplementation by drinking plastic water or by freezing or microwaving plastic food containers is very risky business. Excess estrogen has been shown to increase the reproduction rate of breast cancer tumor cells by over forty times. Excessive estrogen is affecting our children with disorders of sexual maturation, cancer and is potentially contributing to their now famous ADHD issues.

Is that reason enough to boycott plastic water?

On a completely different front, new evidence shows that the metal antimony also leaches from PET water bottles, sometimes in dangerous amounts and may contribute to a host of health issues. If you are concerned about the uptake of metals into your biology, pay attention to this one.

PVC (V) is used in the manufacture of PEX and other plastic water tubes, gym mats, clothing and tek gear, shoes and many of the plastic film wraps used for food storage. Like polycarbonates (#7), PVC off gasses and leaches BPA (a known carcinogen) as well as its own phthalates and dioxins into everything around it; including the air we breathe.

HDPE (#2) plastic is used in making milk

jugs and for bulk water sales. HDPE is the most stable of consumer plastics and off gasses and leaches about 80% less than other common plastic materials. When you must use plastic in your food supply, this is the one to use.

Seldom considered are mold release agents, the chemicals used to help plastic objects such as water bottles pop out of their molds without sticking. The use of fluoropolymers like Teflon™ and its chemical cousins, is barely regulated in the U.S. (As if what we can't see won't hurt us.) Our FDA is not focused on eliminating mold release agents from the food and water supply.

Ibuprofen™ and acetaminophen (Tylenol™) have both been shown to dramatically reduce testosterone in female and male humans. Testosterone inhibitors like these, combined with the excess of estrogen mimicking chemicals in our modern world have created a poisoned environment ripe for the proliferation of zombie people, complete with shattered minds and rotting parts, roaming the world in search of something they will never find.

If the risk of cancer, childhood diseases and the ongoing pollution of land and sea associated with the use of plastics and plastic water bottles is not enough to get you to change current behavior, then this article is of little value and the reign of humans is destined to be thankfully short. Our fate is entirely in our own collective hands. The time for a change was yesterday. What'll it be, kids?

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

New Rebate Helps GMP Customers Save When Switching Away from Fossil Fuel for Cooking

\$200 Rebate for Induction Cooktops Adds to GMP's Programs

Colchester, Vt. – Starting October 1, Green Mountain Power (GMP) customers can save \$200 when they switch from fossil fuel for cooking and install a new electric induction cooktop or range. Induction technology heats up and cools down faster than fossil fuel and provides great temperature control, all without carbon emissions and indoor air pollution. The new induction rebate adds to GMP's growing list of incentives to help customers save money when reducing their own carbon footprints.

"We're so glad to offer this new \$200 rebate. It is a great new way we're serving customers – helping them make the switch away from fossil fuel to clean electricity during their daily lives. GMP's energy supply is 100% carbon free, so cooking with induction technology helps fight climate change efficiently at home while helping to lower per unit power costs for all customers," said Tiana Smith, GMP's head of electrification.

The new rebate is available for installed induction cooktops or ranges (not portable) and is valid on purchases made October 1, 2022 through December 31, 2023. Customers can apply for the induction rebate and see all the details on GMP's website.

GMP's residential customers can also save up to \$2,500 on electric vehicles, up to \$1,000 on heat pumps, \$500 on electric motorcycles and \$100 on electric lawn tractors among other rebates and incentives. GMP business customers can save on EVs, heating and cooling equipment, plus custom electrification projects for their operations through GMP's business innovation programs.

"All of these programs combined with our energy storage initiatives are having a big impact. Last year, all together, customers helped offset more than 210,000 metric tons of carbon through GMP programs. That's like taking about 45,000 fossil fueled cars off the road. It is amazing what we can do together," Smith said. ♻️



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Tick Tack Toe - Away You Go

N.R. Mallory

This story starts in Maine. A woman goes out for a walk with her dog and comes back to find fifty ticks crawling up her legs.

This 74-year-old woman has over 40 years' experience as a registered nurse with most of those years nursing very sick people back to health. She has witnessed firsthand the burdens that these terrible tick-borne diseases can put on patients and their families. This woman is also an experienced recreational Maine guide who loves the outdoors. She is an avid hiker.

This woman is Jane Gower. She lives in Dresden, Maine, a small town in Lincoln County. The area is known to have one of the highest rates of Lyme disease in the nation. Her experience is the prime motivator for her research and development of a safe, affordable product that reduces the risk of acquiring tick-borne diseases, Maine-Jane's Tacklers.

As a longtime crafter, Jane developed an easy-to-use product that works. The product was developed after many hours at her dining room table. The results are an environmentally-friendly way to protect yourself from ticks that crawl onto you as you walk through areas where they are found. The patented design is a system of Velcro and very sticky double-sided tape that fits around a person's ankle. The sticky tape is not washable and can be removed easily. It only needs to be



Maine-Jane's Tacklers fit around a person's ankles, stopping ticks before they can crawl up your leg. Below: a tick stuck in place. (Courtesy photos)

replaced when it has too much debris collected to prevent ticks from climbing on board. She does offer replacement tapes.

While doing her research, everything similar to her product wants you to put DEET or something else on it. (Do we really need to go into the health dangers from using DEET and many of the other chemical products available today for tick protection?) Gower's tick protectors use nothing on them. She said, "It's not about the repelling ticks but about stopping them dead in their tracks. So the goal is to really get a tick on us! This is because each tick we get means there'll be that many less next year." It has been said that one tick can lay from 1,000 to 5,000 eggs. This is a great way to stop them because they cannot crawl off the tick tackler and die on it before they can get to you and lay any eggs after they bite you. Jane goes on to say, "when the tick does begin crawling up one's leg, it gets stuck there in plain sight. But the beauty of it is that they can't crawl, once they're on it they die on it. One less tick means maybe five thousand ticks less for next season."



Green Giving This Holiday Season

Jessie Haas

You love the people in your life. You love your planet. You want your holiday giving to benefit both. Possible? Very much so.

The right book is a gift that can last decades and change lives. In no particular order, I recommend *Walden* by Henry David Thoreau. Warning: this book may send the recipient off to a tiny house in the woods for forty years, to enjoy an outrageous amount of free time. *Farming While Black* by Leah Penniman is for farmers of any color, and those who want to be good allies to them. *Regeneration* by Paul Hawken tells us what we need to do to restore our planet to health and the temperatures we evolved to thrive in. *Naturally Curious* by Mary Holland reveals that our part of the world is absolutely amazing! And once you know that, you'll be even more inspired by *Our Better Nature* by Lindberg and Hagen, a joint project of the Vermont Alliance for Half-Earth and the Northeast Trust, among others.

Rewild half the planet, for its health and ours? It's an ambitious, hopeful idea.

All these books are available from independent booksellers like Northshire, Village Square Books, Norwich Bookstore, and Toadstool Bookshop. Many are published locally, by companies like Storey, Trafalgar Square, and Chelsea Green. Chelsea Green prints their books on recycled paper, and bears a certification from the Forest Stewardship Council. Browse their online catalog for dozens of fascinating titles, many written by local authors. Then buy them at a local bookstore.

For kids, look for ways to give the gift of nature. That's how to grow future environmentalists. Cross-country skis and lessons; a trip to a local nature museum; or an invitation to participate in the Christmas Bird Count. If a family you love is having a hard time affording summer camp, contribute to their camp fund or offer to drive the child to camp (ideally in an EV or plug-in hybrid). Or consider

Cont'd on p.39

I asked Jane to send me some samples to try for myself since I am also an outdoor enthusiast, forager and walk my Newfoundland dog regularly. She sent them to me right away, and included some for my younger grandchildren and an older one who works for DEC to try. I have tried them. They are so easy to simply wrap on my ankles with different lengths in case you are wearing boots. Or small enough to fit on younger children. It is indeed comforting to not be spraying any unhealthy chemicals on my body or on my clothes. The only problem I encountered is that due to the super dry drought conditions all summer, it has meant that I have not seen any ticks — on me or my dog. I will continue to wear them now that they are back and am thankful to have something

that is safer to use and works.

I also love that Maine-Jane's Tacklers™ is dedicated to "Leave No Trace Outdoor Ethics." They enclose a complimentary card in each order with the guidelines to leave no trace. They want to avoid a product that causes harm to any of our outdoor friends. Ticks are not our friends.

Maine-Jane's Tacklers is produced in Maine with all materials made in America. Jane sells the Tick Tacklers in stores around Maine. They are also available online at mainejanestacklers.com, or call her at 207-653-7924. See her ad on page 39 of this edition of Green Energy Times.

N.R. Mallory is the editor, publisher, owner of Green Energy Times. She has been living sustainably and off the grid in Vermont with 100% solar for 20 years. ☼

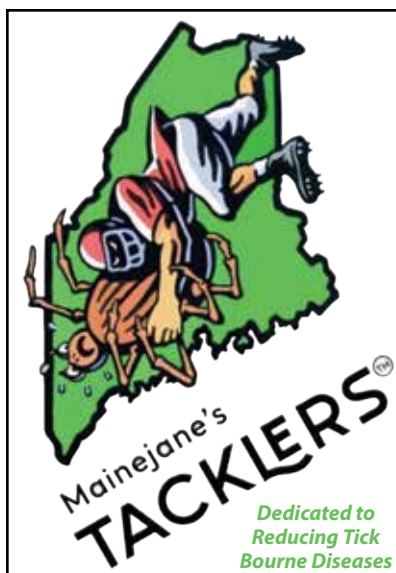
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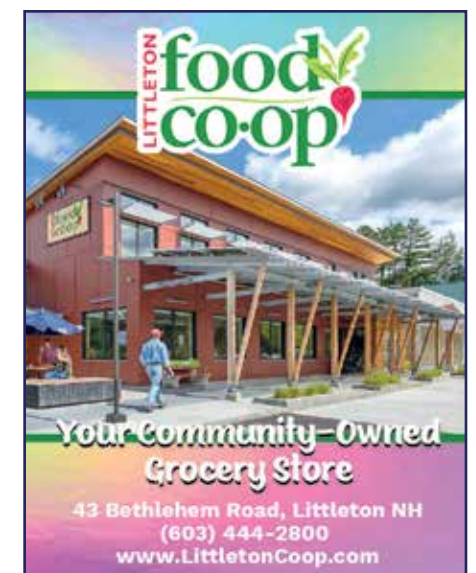
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<< **Green Giving** – Cont'd from p. 38

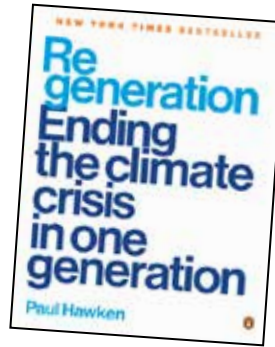
giving or contributing to horseback riding lessons or a dog training class.

For the person who has everything (except a thriving planet), give trees in their name through One Tree Planted. This Vermont company makes it easy to give any number of trees, from one to a hundred, in locations around the globe. May I suggest mangroves? They account for 50 percent of all carbon sequestered in marine sediments, provide critical habitat for many species including tigers, act as a nursery for an incredible variety of marine life, provide food and materials to human neighbors, shield populations from hurricanes and tsunamis, and buffer the impact of sea-level rise. We've lost nearly 50 percent of them since 1980. Restoring mangroves could remove or avoid three billion tons of greenhouse gas emissions by 2030, and you can tuck a few of these magnificent trees into someone's stocking for one dollar apiece. There's almost nothing you can do with a dollar that will have greater impact.

A festive gift for an impassioned gardener might be a basket of

seed catalogs—the exotic ones like Baker's Heirloom Seeds, SeedSavers' Exchange, Turtle Tree Seeds, Kitazawa, or Southern Exposure. Some of these catalogs cost a few dollars, but most are free. The winter holidays may not be the time for gardening, but they're certainly the time to dream about gardening. Another good choice for garden dreamers would be a gift card to Elmore Roots Nursery.

This winter a lot of people are going to be turning the thermostat down to save money on fuel. Yes, this might be better for the environment -- but avoid saying that. Instead give warmth; sweaters, socks, base layers. Choose wool, not polyester, which is made from fossil fuels. Merino wool base layers are buttery-soft, nonscratchy, and make an outsized difference in how comfortable the wearer feels. Wool sequesters carbon, can be composted at the end of its usefulness, and is much warmer than other fibers. Sheep live long comfortable lives eating most of the time;



many of them these days graze under solar arrays, performing a valuable service as they grow wool. Much wool is locally produced, and you can take that even farther by knitting the garment yourself. Or give yarn, to a knitter, providing entertainment as well as coziness. Visit solar-powered

Farm-Way in Bradford, VT to purchase your cozy garments.

If your loved one is deeply attached to polyester, how about a Guppyfriend Washing Bag? You zip your fleece garments into it before putting them in the washing machine. The bag traps the microplastic fibers shed by the fleece, and keeps them out of waterways. Afterward you simply clean that lint out with your fingers and put it in the trash. Not the toilet! That would defeat the whole purpose.

Speaking of washing things, some of the best soap on the planet is made by the Vermont Soap Company. You can clean anything in the house with their Liquid Sunshine, including laundry, and their castile soap, scented or unscented, is strong, gentle, and doesn't leave a residue. It's also organic and made with renewable energy.



Finally, for all the festivals of lights, consider soy or beeswax candles to fill a home with cheer. For outdoors (or power outages) how about a rechargeable headlamp, or shop flashlight? Every car should have a flashlight that can be plugged into the cigarette lighter or phone charger, and in this season when we turn toward the dark and deep, a simple string of LED lights in a corner, draped over a plant, or even coiled in a large canning jar, can bring that twinkle of light, cheer, and hope we all crave.

Wishing you joy.

Jessie Haas lives in a 450-s.f. off-grid cabin with husband Michael J. Daley. She is the author of over 40 books, including The Hungry Place. ♻️



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STP210-18/Ub-10	Used	Phoenix	1050 pcs	\$0.25/W	\$0.23/W
AIONRise 330W	Mono, 60 Cells	Texas	2325 pcs	\$0.72/W	\$0.69/W
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Suniva MVX320-72-5-800	New, Poly, 72 Cells		320 pcs	\$0.48/W	\$0.47/W
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Suniva OPT 270W B40-B3A01			150 pcs	\$0.52/W	\$0.48/W
Suniva OPT 275W S40-W5A01-210			172 pcs	\$0.52/W	\$0.48/W
Suniva OPT 275W B3R-B3A01-W			1247 pcs	\$0.52/W	\$0.48/W
Suniva OPT 280W B35-B5A01-W			225 pcs	\$0.52/W	\$0.48/W
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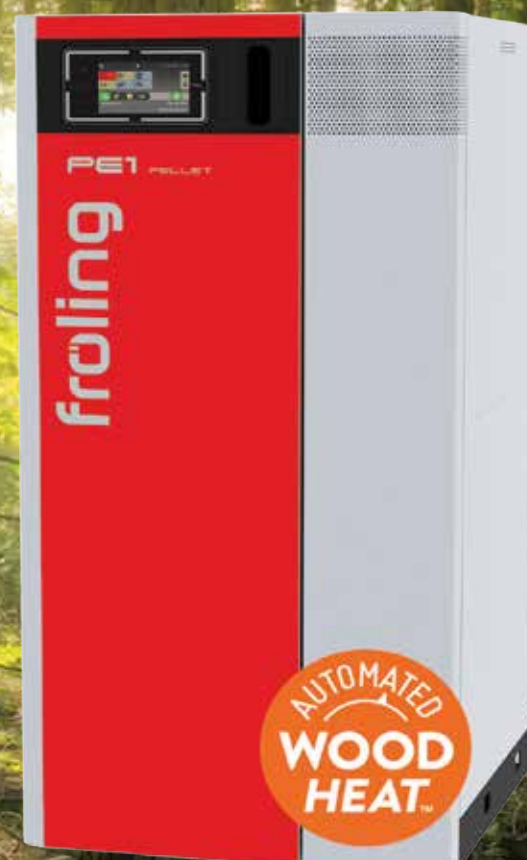
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