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## What's the Difference Between 1.5°C and 2°C of Global Warming?

*George Harvey*

We have been hearing for some time that we need to stop temperature increases from climate change at 2°C (3.6°F) to avoid the worst catastrophes, but anything upwards of 1.5°C (2.7°F) will be pretty bad. The difference is so small. Why worry over such a small thing?

It's partly about ice.

There are few chemicals more fascinating than water. Whole books have been published with nothing but pictures of snowflakes. They are pretty, but the science relating to the phase changes of water, as it melts and freezes, is nothing short of amazing. There is a small difference in temperature between the two, but our lives depend on it.

Ice can exist at 0°C (32°F), and if no energy is going into it, it does not melt. Water can exist at the same temperature, and if no energy is being extracted, it does not freeze. There seems to be some sort of balancing act going on here. How does that work?

*Global warning. Planet as melting ice cream under hot sun. (AdobeStock_209217051/sveta)*

A calorie (as used in physical sciences) is the amount of energy required to raise one gram of water by 1°C. The amount of energy it takes to melt a gram of ice at 0°C into water at 0°C, without changing the temperature, turns out to be about 80 calories. If you measure the amount of heat it takes to convert a given volume of ice into water, without raising the temperature, and then apply the same amount of heat to the water, you will raise its temperature to about 80°C (176°F). It takes a lot of heat to melt ice.

The converse is also true. When water freezes into ice, it releases a lot of heat. That is why ponds can have water under the ice, if they are deep enough.

We know that glaciers are melting. They have been retreating up valleys, and in

*Cont'd on p.23*

## GREEN RESOLUTIONS FOR 2022

*Janis Petzel, M.D.*

As we turn the corner to a new year, we will probably make some resolutions to do things that will improve our lives. Sustainable resolutions may be on your list. How can you incorporate them into your life? Here are some thoughts to get you on the road to a sustainable 2022.

Sustainability requires balancing the needs of living organisms over generations within the limits of physics, biology, and human psychology (which is the real impediment to achieving it). The extraction and burning of fossil fuels is not sustainable by any definition.

Your personal actions make a difference. In the Northeast, household energy use has gone down from 138 million BTUs to 93 million BTUs since 1980. Is that from the insulation you installed? And the energy efficient appliances? They had a positive impact.

Pew Research indicates 74% of us are willing to make changes to reduce climate risk. But what specifically can you do?

**1. Develop a Loving Relationship with Nature:** Appreciate nature for itself, but also understand what we are at risk of losing.

- Get yourself and your children off screens and into the outdoors as often as possible.
- Protect places and living things you love. It's a sort of zone defense for Mother Nature. Pay attention. Raise your voice if this living space is threatened.
- Grow some of your own food. It's satisfying in a way that store-bought food is not, even if it's just a pot of parsley on your windowsill.

**2. Power in Numbers:** Staying informed and making your voice heard makes a difference.

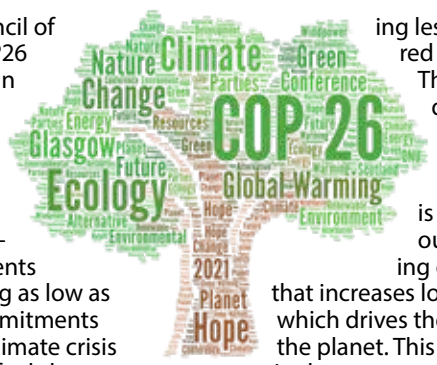
*Cont'd on p.39*


*Happy New Year to our readers! May you resolve to make greener resolutions in 2022. (AdobeStock_466514440/ flyalone)*

## LIMITED PROGRESS MADE AT COP 26

*Dr. Alan K. Betts*

The Council of Parties COP26 took place in Glasgow from Oct 31- Nov 12. It was the first since the 2015 Paris meeting, which laid out guidelines and voluntary commitments to hold global climate warming as low as 1.5 to 2oC. Many of these commitments have not been kept, and the climate crisis from the burning of the fossil fuels has deepened in the past six years. This year has brought climate disaster after disaster. We have known for decades this was coming, but atmospheric CO2 keeps rising, as most societies make promises they do not keep.




The first part of the Sixth Assessment Report (AR6) was released in draft form in August 2021 in preparation for this COP26 meeting. It was described by the UN Secretary-General António Guterres as nothing less than "a code red for humanity. The alarm bells are deafening, and the evidence is irrefutable."

The key issue is rapidly phasing out the burning of fossil fuels that increases long-lived CO2 which drives the warming of the planet. This heat is stored in the oceans and increases evaporation. In turn, global water vapor, a powerful greenhouse gas (GHG) goes up and reduces global ice cover. The loss of ice cover translates to loss of cooling by reflecting sunlight. Rapid action has been postponed for decades, because our business-as-usual growth economy depends on fossil fuels, and cutting the use of fossil fuels threatens the very powerful fossil fuel empire that controls the government in the U.S., as well as global policy.

In thirty years, none of the first 25 COP reports even mentioned the fossil fuels!

Methane leaking from the expanding fossil fuel infrastructure (as well as decaying waste at landfills and livestock farming) has become a growing GHG threat

*Cont'd on p.22*

## IN THIS ISSUE



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# GREEN ENERGY TIMES' *TEAM HELPS SAVE THE PLANET*

***Part Two in Our Feature Series***

Green Energy Times *staff*

At *Green Energy Times*, we love what we do. We love getting the word out on saving the planet from climate change and pollution. We love helping people be energy-independent. We love the healthy lifestyle and clean environment an unpolluted world can offer.

One thing we have always loved, but never focused on much in the past, is walking the talk – actually doing the things we advise others to do. We can take pride in the accomplishments we have in our own lives, whether they be big things like switching to an electric vehicle, or little things like turning the thermostat down and wearing warmer clothes.

We all try to reduce emissions and waste wherever possible. We do it ourselves because we know that if all the people in our country did that, we would all lead richer, more satisfying, healthier lives. But to get to that place, most of us have to participate actively. Those of us who know about it have to undertake to lead, telling those who are not aware about the need to improve our lifestyles. And to lead, we have to do all the little things that eventually will add up to something monumentally big, when we are all engaged.

In this issue, we will take a look at the responses we got from three of our volunteer distributors when we asked about their lives.

**Cliff Babkirk** – *G.E.T.* volunteer distributor for Maine

*Cliff Babkirk's Kia Niro filled with* G.E.T. *bundles for distribution. (Courtesy image)*

"We just put 9.5 gallons of gas in our new Kia plug-in hybrid that carried us 1625 miles along with plug-in power from our PV system that is still letting us bank a couple of hundred kilowatt hours per billing period. That's 171 miles per gallon."

**G.E.T. comments:** Cliff Babkirk delivers G.E.T. using a plug-in Kia Niro, pictured on this page. Some people adopt green options in life because it is good for the planet, others go to green options because they save money and make life easier. Though Cliff Babkirk may be one of the former, he provides an example to the latter of how electric vehicles and solar power systems can work together to save their owners quite a lot of money.

**JS Fitzpatrick** – *G.E.T.* volunteer distributor in the area of Littleton, NH

"I'm fairly energy-conscious, very by some measures. A number of years ago I installed solar on my house, changed out my oil burner for pellets and purchased a plug-in hybrid vehicle. All those moves have saved me money and made me feel better. I'm also part of a group that has convinced others nearby to make similar energy saving moves. However, these types of behavioral changes on a personal level by me and many others hasn't been near enough to stem the tide. Big institutional changes prompted by government direct funding and incentives are necessary, but unlikely to happen soon.

It's good that individuals are stepping up, saving money and doing what they can, but it is nowhere near enough." *G.E.T.* comments: JS Fitzpatrick tells a familiar story of how our volunteers provide examples of how people who set out to be environmentally responsible can save financially and live healthier happier lives.

He makes another observation, however. It is necessary that our government stop encouraging emissions from fossil fuels and take up the point of view that the environment is important and needs protection. It happens that renewable energy use in off-grid and microgrid situations is scalable. The entire nation could benefit from the energy security, low costs, high reliability, and clean environment that is provided by resilient renewable energy.

**Russ Lanoie** – NH Volunteer Distributor in the Conway and Mt. Washington area.

*Russ Lanoie's passive solar (1976) house with Daystar solar hot water system installed in1978, solar greenhouse, sunporch that gets glazed for winter, and, most importantly, the solar clothes dryer. (Courtesy images)*

"We live in 1976 passive solar house with mini-splits and wood backup. We have a Daystar (Exxon) solar hot water system. An 11.5 kW PV system provides all of our electricity, including for our 2021 Kia Niro plug-in hybrid. It is

*Cont'd on p.17*



**Concentration of CO2 in the Atmosphere**

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***December 6, 2021***

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# Local Impacts of Global Change
# Vermont Climate Assessment Shows Climate Change Has Arrived

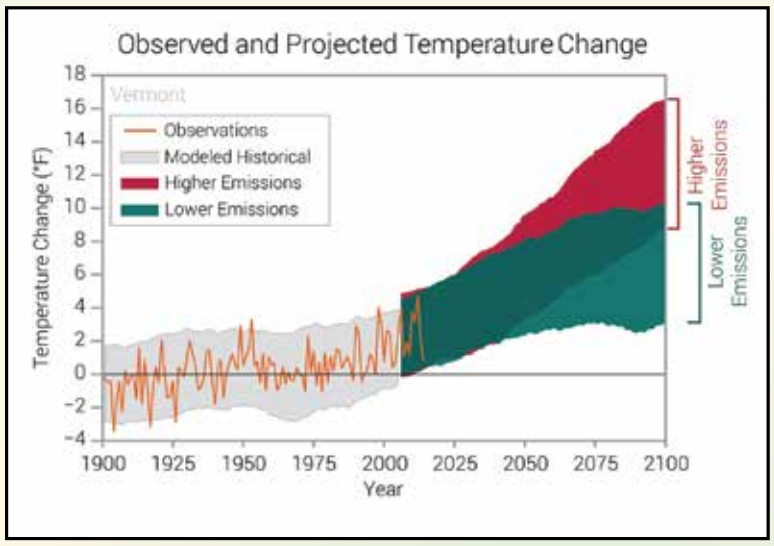
*Emma Cotton, VTDigger*

Vermont is already warmer and wetter because of climate change, a new report affirms, and researchers expect the state's ecosystems, industries and communities to change dramatically in the coming decades.

Throughout the past year, Vermont has experienced a range of impacts that are likely connected to climate change, such as drought conditions and flooding in southern Vermont.

Blue-green algae bloomed in Lake Champlain, mosquitoes swarmed in Addison County and Mount Mansfield, the state's tallest peak, set its record for the latest freeze — more than a week later than its previous record.

Changes like these are likely to continue and accelerate, according to the 2021 Vermont Climate Assessment.




*Observed and projected temperature rise for the state of Vermont, 1900 to 2100.*

At a press conference on November 9, 2021, researchers and advisers from the University of Vermont and the Nature Conservancy presented the study, which built on the 2014 Climate Assessment, the first state-level climate study in the country. Gillian Galford, research associate professor with UVM's Rubenstein School of Environment and Natural Resources, and Joshua Faulkner, research assistant professor with University of Vermont Extension, led the assessment.

Lesley-Ann Dupigny-Giroux, Vermont's state climatologist, who recently spoke via remote video at the UN climate conference in Glasgow, Scotland, also served as an adviser of the study.

"Climate change is here," said Stephen Posner, policy director at UVM's Gund Institute for Environment and an adviser of the assessment. "It's impacting communities across Vermont now, today. We can see that happening when we look at the data and the scientific evidence."

Though the climate likely will remain relatively mild in Vermont — possibly prompting climate migration in the coming decades — average temperatures have already risen by 2ºF, and may warm by between five and nine degrees more by 2100, depending on the emissions scenario, according to the study.

Vulnerable groups face an even bigger risk than the average population, a fact state and local officials should account for in their planning efforts, the assessment said.

Many iconic Vermont features are at risk. In 25 years, the common loon and the hermit thrush could disappear from the state, along with dozens of other bird species, the study said. Projected fluctuations in temperature mean ski resorts likely will need to rely on robust snowmaking operations to keep the industry viable until 2050, and maple sugarers could face a decrease in production.

"The goal here, really, is to help inform many different types of decision-makers here in Vermont, from lawmakers to farmers," Posner said. "This report is written to help citizens and decision-makers make sense of climate data and prepare for future impacts across these kinds of sectors."

## Temperature

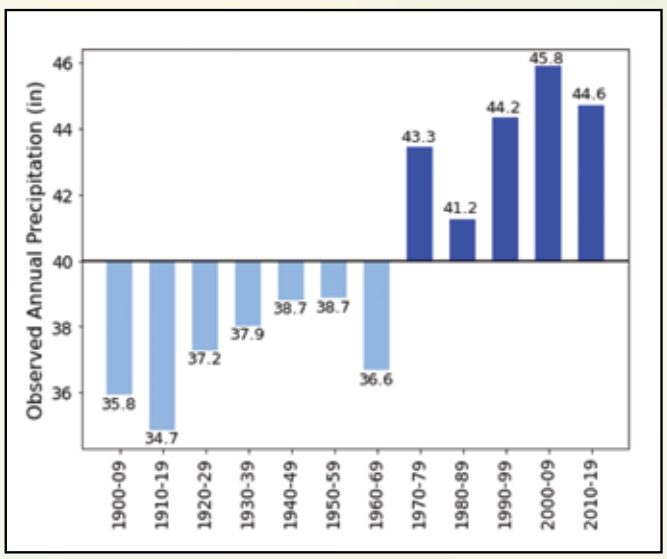
Climate change has caused average Vermont temperatures to rise by two degrees Fahrenheit since 1990, according to the assessment.

Since 1900, the freeze-free period — the number of consecutive days with minimum temperatures above 28 degrees Fahrenheit — "increased at a rate of 1.7 days per decade, which accelerated to 4.4 days per decade since 1960 and again to 9.0 days per decade since 1991," the assessment said.

Temperature changes have affected the winter season most dramatically and rapidly, according to the assessment. Since 1960, winter temperatures have risen 2.5 times faster than average annual temperatures, and water bodies are thawing sooner each spring.

Southeastern Vermont experienced the most significant warming trend in winter, followed by northeastern and western Vermont, according to the assessment. The average number of "very cold nights" has decreased across the state.

"Climate change is already progressing more rapidly in southern Vermont," Galford, an author of the assessment, said Tuesday. "We may see different effects in different parts of the state."




*Vermont received around 35 inches of precipitation per year in the early 1900s, similar to Chicago. Now, Vermont receives around 45 inches per year, similar to Portland, Oregon. The center line represents the 100-year average.*

## Water

Between the early 1900s and 2020, average yearly precipitation increased by 21%, marking an increase of 1.4 inches per decade, the study said. In the early 1900s, Vermont's annual precipitation was akin to average precipitation amounts in Chicago. Now, precipitation in Vermont looks more like an average year for Portland, Oregon.

Researchers expect flooding to increase, which means improved stormwater infrastructure could reduce damage to homes, roads, bridges and farm fields. Increased rain likely would cause more runoff from farms and developed surfaces into streams, lakes and ponds. Runoff and warmer water temperatures could create ideal conditions for blue-green algae blooms.

Still, amounts of rain and snow remain "highly variable from year to year" — droughts and prolonged dry spells are projected to become more frequent, too.

"I have absolutely seen farmers dealing with more drought, and that's evidenced by really a strong uptick in interest in irrigation-related information and understanding what technologies are available to implement on their farms," Faulkner, an author of the study, said Tuesday.

That variability means that, "while Vermont's winters may become milder and less snowy on average, any given year could be quite snowy," the study said.

## Plants and animals

Changes in temperature and precipitation would likely prompt a web of other troubling impacts on Vermont's nonhuman life, according to the assessment.

For example, migratory birds "rely on booms in insect populations during the spring to recover from the physical strains of traveling and to support reproductive strategies," it said.

If the birds migrating through the state miss that insect boom because of changes in temperature or water, they might be "unable to take full advantage of the insect boom and may starve or fail to reproduce," the study said.

Temperature changes that affect habitat could harm species like the Bicknell's thrush, which relies on alpine vegetation to breed.

The common loon and hermit thrush are among 92 bird species expected to disappear from Vermont in the next 25 years, according to the assessment. Over time, moose populations likely will decline, while white tailed deer populations are projected to grow. As conditions become more ideal for bugs such as mosquitoes and ticks, insect-related diseases also may become more prevalent.

Forests are beginning to see effects from climate change, according to the study. Some tree species that tolerate warmer temperatures — northern red oak, shagbark hickory and black cherry, for example — may benefit in the future. Others, such as sugar maple, balsam fir, yellow birch and black ash will be negatively impacted, according to the assessment.

"While growing conditions will be significantly different by 2100, actual change in forest makeup will follow a delay as older trees die and are replaced by young ones," it said.

Forests may also face threats from growing populations of pests, invasive plants and diseases.

## Bringing it home

Vermont's Climate Council is racing to meet a December 1 deadline for its Climate Action Plan, which would guide stakeholders throughout the state as they attempt to reduce greenhouse gas emissions and prepare the state for climate change. Several of the assessment's advisers serve on the climate council, and Posner said Tuesday the assessment has been shared with council members.

The temperature projections included in the assessment, however, are based on global greenhouse gas emissions. Leaders from around the world are negotiating climate policies that could lower emissions at the COP26 conference in Glasgow, Scotland.

The study is intended to make broad information about climate relevant to Vermonters, Galford said Tuesday.

*From left: Gillian Galford and Joshua Faulkner, lead authors of the Vermont Climate Assessment, and Lesley-Ann Dupigny-Giroux, state climatologist and an advisor to the project. (Images: University of Vermont)*

"I know that when we receive information on the national scale or about New England, it's very hard to enact decisions, policies, plans at a really local scale — at the scale of our town, and the scale of our farm, at the scale of our state," she said. "I hope that this information is empowering in making those decisions on those more local scales."

*Links available in the original article at VT Digger (www.bit.ly/3pu70XL).* ♻

# EV Charging Rates Come to New Hampshire

*Sam Evans-Brown*

As we write this, proceedings are underway that will determine whether you'd be able to fuel up an electric vehicle and how much it will cost in New Hampshire. Three dockets are open at the Public Utilities Commission that will determine how much the utilities spend to prepare the grid for public fast-charging, whether there will be a business case for public fast-chargers, and what it will cost to charge at home.


*Fast charging stations for EVs (Flickr/Earth and Main)*

## Demand Charges and Fast Charging

In the biz we call fast charging direct current fast charging, or DCFC. When folks who don't own an EV think about reasons why they wouldn't get one, the lack of fast charging infrastructure is high on their list.

While it's pretty rare that you need the entire range of a modern EV's battery, fast charging is important for tourism, road trips, and for getting people comfortable with the idea of owning an EV, and so more DCFC is an important catalyst for EV adoption.

That's why the NH utilities' proposals for DCFC electric rates are a real problem. The consultant that Clean Energy NH hired in partnership with the Conservation Law Foundation to review these proposals, recommended rejecting them. When I spoke with him in November Chris Villareal told me, "their heart is kind of in the right place, but what they've proposed is not going to work for the time frame of what we're going to see for EV adoption rates."

For customers that use a lot of electricity, utilities have a special billing mechanism called a demand charge. Demand charges reflect the fact that pulling so much electricity off the grid requires expensive grid upgrades. But they also cripple the economics of DCFC stations. Clean Energy NH learned last year, for instance that some of the few fast charging stations we have in New Hampshire pay the equivalent of $3.08/kWh, which is something in the neighborhood of 15 to 18 times what you likely pay per kWh at home.

The Rocky Mountain Institute has found that until there are enough EVs driving around that a car is plugged into a fast charger 30% of the time, demand charges will continue to be so expensive that they will make DCFC unprofitable. It's a chicken-and-egg problem: no fast charging makes it so people are afraid to get an EV, and no EVs make fast charging uneconomic. That's why states around the country are proposing demand charge "holidays" until there are more EVs on the road.

But "they did not propose that in New Hampshire," Villareal points out, "In New Hampshire they proposed a simple three-year increase over time, regardless of how it's used." This is why we recommend the PUC reject the utilities proposals, and come back with something more grounded in the reality of the pace of EV adoption in NH.

## Time of Use Rates and Slow Charging

First, some EV charging lingo. Level 1 charging is when you simply plug your car into a standard wall outlet. That provides up to six miles of range per hour of charging. Level 2 is more like a dryer outlet, which provides around 35 miles per hour of charging. Compare those to DCFC, which can add 150 miles or more in an hour.

While fast charging occupies a lot of space in people's thinking about owning an EV, slow charging will actually be the bread and butter. Currently, somewhere in the neighborhood of 80 percent of all charging happens at home, and the median range of an American EV is now over 250 miles. Think of it this way, how often would you need to stop at the gas station if you woke up every morning with a full tank?

What's more, slow charging can actually reduce electricity bills for non-EV drivers. By ensuring that slow charging is happening at times when our grid is under-utilized, such as the overnight hours, we push more electrons through the same wires. And more efficient use of our electricity infrastructure means lower electricity rates overall. In other words, encouraging people to charge overnight will help make the energy transition more affordable for all of us.

That's why we at CENH likes Unitil's proposal. Here's what they laid out.

- Charging overnight, from 8pm to 6am would be cheapest.
- Charging during the day, from 6am to 3pm would be in the middle.
- Charging in the evening, from 3pm to 8PM, when the grid is most stressed, would be most expensive.

On average in Unitil's proposal, there's a 3:1 ratio between the most and least expensive times to charge your car. In other words, charging at 5PM would cost you three times more than charging at 10PM.

We like this scenario, because it puts the power to decrease stress on the grid in the customer's hands. What's more, if other companies want to come in and offer "smart" charging--say a charger that you can leave your car plugged into all day, but will only activate once you hit 8PM--it gives them a strong price signal to respond to.

On the other hand, a proposal we didn't like was Eversource's proposal to do "managed charging." Managed charging is when EV charging is turned off and on dynamically, from moment-to-moment, in response to the status of the grid.

"Managed charging is not a bad thing," says Villareal, "It's just that there's no reason it shouldn't be a competitive product." We like the idea of managed charging. We just think that Eversource should leave that type of service to the competitive marketplace.

"Eversource is leveraging its utility role to expand their monopoly," explains Villareal.

Opening up innovative market structures to any company that wants to compete will help keep down the cost of equipment that enables good ideas like interruptible, managed EV charging. The energy transition must be affordable, and we need to push for good policies to ensure it will be.

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

# Cost of EV Ownership

*Adapted from an article at Drive Electric Vermont*

Drive Electric Vermont

All-electric vehicles (AEVs) have a fraction of the moving parts of gasoline vehicles and are very reliable. That means no oil changes, no spark plugs, catalytic converters or other emissions equipment. They also use fixed gears instead of transmissions which further reduces maintenance. As a result they only need to be serviced once or twice a year to check vehicle systems and rotate the tires.

Plug-in hybrid electric vehicles (PHEVs) have internal combustion engines but still require less maintenance than typical gasoline cars, since the engines are used less often and regenerative braking systems save wear and tear on the brakes.

Below are links to several resources to help calculate estimates of cost savings with electric car ownership and potential long term issues associated with vehicle batteries.

## Go Further with an Electric Car

The calculator tool estimates how switching to an EV could save on fuel costs by estimating how far you can go for the same price as a gallon of gasoline. The default values reflect current average Vermont electric and gasoline prices from the U.S. Energy Information Administration. These are customizable to better reflect your costs and vehicle efficiency (www.bit.ly/GET-COO-2). Your electric utility may offer special off-peak rates for EV charging to help lower your costs even further!

A tool at www.bit.ly/GET-COO-1 can compare the cost of a gasoline vehicle with the cost of an electric vehicle, so visitors to the site can make the numbers relevant to their own situations. The example given at the site is based on real numbers and says that on a given set of fuel costs, the electric vehicle can go a bit more than twice as far for the same amount of money.

## Estimated annual savings

The annual cost comparison shown below is based on the above cost and efficiency information combined with estimated annual vehicle use of 12,000 miles per year.

- Gasoline Vehicle: $1,700 a year
- Electric Vehicle: $775 a year
- Switch to electric and save big on fuel.

Estimated annual savings is $925 for the electric car. Over five years, that savings adds up to $4,627.

*Cont'd on p.6*

# Push for Clean Mobility Spurs Electric Vehicle Infrastructure Expansion

*Kathleen Connors*

Headlines these days are buzzing about the burgeoning electric vehicle (EV) market. The strong push for clean mobility is energized by various factors, including technological advancements in batteries and electric motor design. Industry advocates also seek to reduce the nation's reliance on fossil fuels, especially in the transportation sector, the single-largest contributor to greenhouse gas emissions in the United States.

More drivers than ever are willing to drive electric, especially with a wider range of EV models coming to market. Yet some still hesitate due to "range anxiety." It's a valid concern, given that charging stations are few and far between outside of a few major metropolitan areas, according to the Pew Research Center. With a reported 216,000 charging stations available in 2020, the nation currently has about 10% of what it requires to support future projections for plug-in vehicle sales, per a July 2021 white paper by the International Council for Clean Transportation.

The escalating popularity of EVs, decarbonization efforts, and other priorities are bolstering investments in EV charging infrastructure. In fact, President Joe Biden recently authorized a $1.2 trillion infrastructure bill that will be a real game-changer for e-mobility. The funding package includes $7.5 billion to support his vision of adding 500,000 EV charging stations nationwide.

Several states in the northeastern U.S. already rank high on the leaderboard of EV-friendly places to live. The latest "State Transportation Electrification Scorecard," published by the American Council for an Energy-Efficient Economy (ACEEE), uses a 100-point rating system to identify states with robust programs and policies that encourage EV adoption. The top 10 list includes New York (63.5), Massachusetts (54.5), and Vermont (49). New Hampshire, with only 13 points, did not qualify for ranking.

In 2021, Voltrek's home state of Massachusetts was No. 2 in the nation for incentivizing EV infrastructure investments, according to Plug In America, a leading EV advocacy group. Voltrek's EV charging experts partner with businesses, cities, government agencies, and utilities across the Northeast to deploy commercial-grade charging stations. Most of these installations are open to the public and easy to find; here are some convenient spots where drivers can recharge their vehicles:


*Bulger Veterinary Hospital in Lawrence, MA, utilized National Grid's make-ready program to help finance the installation of nearly a dozen ChargePoint stations. (Steven Bullock, courtesy of Voltrek)*

MassDOT Service Plazas on Route 24 in Bridgewater, MA: ChargePoint Express 250 stations with CHAdeMO and CCS-1 connectors (allows for 62.5kW-120kW charging)

MassDOT Service Plazas on I-90 (Massachusetts Turnpike) in Charlton, Framingham, Lee, and Natick, MA: EVgo stations with CHAdeMO and CCS-1 connectors (allows for 50kW charging)

Hilton Garden Inn in Watertown, NY: ABB Terra HP stations with CHAdeMO and CCS connectors (allows for 175kW-350kW charging)

Bulger Veterinary Hospital in Lawrence, MA: ChargePoint Express 250 station with CHAdeMO and CCS-1 connectors (allows for 50kW charging) and ChargePoint CT4021 stations with SAE J1772 connectors (allows for 7kW charging)

According to the U.S. Department of Energy (U.S. DOE) Alternative Fuels Data Center, the majority of U.S. public charging stations are Level 2, which are compatible with any EV and can typically top off a vehicle in five hours or less. There are also high-power Level 3 (direct current fast charging) systems available that feature either a CCS, CHAdeMO, or Tesla connector and usually replenish batteries in under an hour. The fastest EV charger on today's market is ABB's Terra 360. Slated for U.S. rollout in 2022, the Terra 360 is capable of fully charging an EV in 15 minutes or less.

For 2020, the median EPA-estimated driving range for all-electric vehicles exceeded 250 miles, with an estimated maximum range of 400+ miles. Newer, more advanced models can cover even longer distances. The high-performance 2022 Lucid Air Dream Edition Range, for instance, can reportedly top 500 miles between charges.

Many EVs have applications built into them that help drivers identify charging locations. There are also other great resources with information about the different EV charging options available, how to locate them, and estimated charging times. ChargePoint, the world's largest EV charging network, has a useful app for locating stations for its brand as well as other major charging providers. Another go-to resource is PlugShare, a free app with the most accurate, comprehensive public charging map worldwide. Its database contains info on nearly 500,000 charging stations—including 190,000+ in North America. Plug In America is a great option, too, offering a wealth of information about purchasing EVs, incentives for charging station installation, charging station mapping, and more.

Electric mobility represents the next natural step in the transportation evolution. Investing in EV infrastructure is critical, as it helps to ensure that Americans from coast to coast have equitable access to clean mobility options. For those interested in supporting EV adoption, visit www.pluginamerica.org for ideas on how you can make a difference.

*Kathleen Connors is the founder and CEO of Voltrek, an EV infrastructure solutions firm based in Lawrence, MA.* ♻

## How Many EV Charging Stations Are in Your Area?

The U.S. Department of Energy Alternative Fuels Data Center keeps tabs on how many public EV charging stations are available in each state. As of early December 2021, the data showed: New York (2,740 locations and 6,754 ports); Massachusetts (1,997 locations and 4,403 ports); Vermont (312 locations and 836 ports); and New Hampshire (142 locations and 319 ports). Combined, these four states contain approximately 5,200 charging station locations and 12,300 ports. ♻

# The ICE is Melting for Electric Transportation

*George Harvey*

In 2018, Elon Musk told the stockholders of Tesla that he wanted a huge bonus, $55 billion, if he could get the company's market value to $1 trillion by 2028. Experts at The New York Times called the goal "laughingly impossible." After less than four years, Musk's "impossible" ten-year goal has been achieved, and Tesla's market capitalization is greater than those of Toyota, Volkswagen, Daimler, GM, Ford, and BMW put together.


Tesla


2011 Nissan Leaf

Of course, Tesla does not sell anything like as many cars as those other makers. But market capitalization is not based on sales. It is the result of analyses by investors in the stock market. And they see things that most Americans do not. The market for internal combustion engines (ICEs) is in deep decline, and that of electric vehicles (EVs) is growing rapidly.

It is a watershed change. We in the U.S. don't see it because our government has not pushed it and legacy auto companies have only just begun dealing with it. But in the rest of the world, the changes are profound.

EV sales were up in China in October 113% from the year before. This happened in an overall market that was down 5%. In Germany, plugin car sales were up 12%, year on year, as the overall market was down 35%. In France, plugin car sales were up 55% in a market that was down overall by 31%. In Norway, over 90% of new cars sold are plugin types. The list goes on.

Car companies in this country are beginning to see the "hand writing on the wall" for ICEs. Ford is finally trying to take a leadership position with its Mustang Mach-E, the F-150 Lightning, and E-Transit electric cargo van. It had projected selling 300,000 of these per year. Now it has doubled that goal and wants to sell 600,000 in 2023.

We don't see electric buses much in this country. One report published late last year said there were 650 of them in the U.S. But we are far behind much of the rest of the world in this also. Bogotá, Colombia has 1,485 electric buses. So one city in Latin America has more than double the number of electric buses that there are in the entire U.S.

There is resistance, both here and in other countries. And the fact that Tesla has greater market capitalization than a bunch of legacy companies speaks to that. Legacy companies want to sell their ICEs. They have the engines, and they have the machinery to make them. When they stop making ICEs, they will lose a lot of value because of stranded assets. Investors have seen that and taken it into account when they put value on companies.

In one case, Toyota was at the cutting edge with the introduction of hybrid vehicles. But now, it seems to be betting on hydrogen fuel cells, which, most critics think, are likely not to work well. That might also have to do with a sort of stranded assets.

We at *Green Energy Times* have a word of advice for our readers. It is not just corporations that are vulnerable to having stranded assets. We, as individuals, can have them as well. And we would bet that the value of a car that needs to burn fuel could plummet as the market changes. The day will come when range anxiety will be a problem for owners of cars with internal combustion engines, as drivers wonder how far it is to the next gas station. ♻


*Abandoned car. (Eric McLean, Pexels, https://bit.ly/3DRuCvc)*

# Optimizing Freight Transport Can Substantially Reduce Emissions

*The American Council for an Energy-Efficient Economy (ACEEE)*

Freight movement in the United States accounted for 31% of all transportation-sector greenhouse gas emissions (GHG) in 2019, and its share of these emissions continues to grow. A new ACEEE working paper and accompanying series of topic briefs explore the potential to reduce freight GHG emissions using emerging technologies that are commercially available today. Our new resources focus on logistical improvements enabled by information and communications technology (ICT) but also discuss vehicle electrification, automation, and connectivity. Transportation-related ICT includes software that enables real-time tracking of vehicles, loads, freight demand, warehouse capacity, and other factors. When used effectively, these data can reduce the miles that empty trucks drive after making a delivery and thus optimize freight transport.


*(AdobeStock_116654227)*

Our preliminary results show that, in the short and medium term, ICT-based operational improvements, such as shifting from truck to rail or optimizing truck loading, can provide the majority of potential GHG reductions. By 2035, annual GHG emissions for intercity and regional truck freight can be cut by 41%, or 76 million metric tons, from business-as-usual levels, with ICT-enabled reductions representing 55% of the total. By 2050, the ICT share of annual emissions reductions could fall to 30%, as the benefits of electrification will have grown dramatically.

Our research suggests that while vehicle technology improvements such as electrification and automation have great long-term potential for emissions reductions, applying ICT-enabled logistical improvements can achieve substantial emissions reductions in the next 10 to 15 years, a period in which establishing a rapid trajectory toward eliminating emissions will be essential. In the longer term, both vehicle- and system-based strategies will be necessary.

Learn more in the new ACEEE working paper, Achieving Freight Transport GHG Emissions Reductions Through Emerging Technologies, and three accompanying briefs in our smart freight series: Maximizing Truck Load Factor, Ports at the Forefront, and Data Exchange at https://bit.ly/Freight-Transport-Emissions

*The American Council for an Energy-Efficient Economy (ACEEE), is a nonprofit research organization, that develops policies to reduce energy waste and combat climate change. Its independent analysis advances investments, programs, and behaviors that use energy more effectively and help build an equitable clean energy future.* ♻

ACEEE
American Council for an Energy-Efficient Economy

## Cost of EV Ownership

*Cont'd from p.4*

### EV Operating Cost History

A chart at the Drive Electric Vermont website compares the average monthly cost of driving electric versus gasoline prices over the past six years (www.bit.ly/GET-COO-1). On average, driving an EV is the equivalent of about $1.50 per gallon of gasoline. EV costs are also much more stable since the state regulates electric utility rates. Adding up the potential savings over the past five years, an average Vermont driver could have saved about $2,000 with an EV.

### Further Compare

Use the U.S. DOE Alternative Fuel Data Center's Vehicle Cost Calculator to compare the total cost of ownership for EVs and other types of vehicles: www.bit.ly/GET-COO-3.

The U.S. DOEhas a special calculator for plug-in hybrid electric vehicles (PHEVs): www.bit.ly/GET-COO-4.

The U.C. Davis EV Explorer offers a handy calculator to consider your commute costs for electric and gasoline vehicle options: www.bit.ly/GET-COO-5.

### Costs Overview

How much will I save with an EV?

In addition to the savings on fuel noted above, EVs also have lower maintenance and repair costs. A *Consumer Reports* study estimated EVs could cut typical maintenance costs in half when compared to gasoline-powered vehicles, with an average savings over the life of an EV of $4,600 (www.bit.ly/GET-COO-6).

Want more information? The Edmunds True Cost to Own calculator may also be helpful if you're looking to figure out how much it costs to own a specific EV model (www.bit.ly/GET-COO-8). ♻

# GO GREEN IN 2022

*Tom Belair*

Everyone seems to be talking about "going green," but that can mean different things to different people. For some, it's buying local food and vegetables, so they don't have to be trucked here from far away. For others, it means biking when they can, rather than driving. Still others take bigger steps, like installing a rooftop solar PV system, or buying an electric vehicle (EV). Whatever it means to each of us, there are things we all can do to be greener.

Greenhouse gas and other harmful emissions come from three main sources: 1. transportation, 2. electric generation, and 3. homes and buildings. If we want to become greener in these three areas, here are some ideas for making a difference in 2022.

## On the Road:

Auto (and truck) designers are building more efficiency into their vehicles every year. From aerodynamic improvements to the rise of EVs, efficiency is the name of the game today. So, what can we do to be greener and more efficient with our vehicles?

- **Good:** Change the oil regularly, keep it tuned up and drive our vehicles more efficiently.
- **Better:** On the next purchase, buy a more efficient vehicle (one with better MPG).
- **Best:** For your next vehicle, consider buying a hybrid, a plug-In hybrid or a full battery electric vehicle (visit www.NHEC.com/drive-electric to see incentives for members purchasing EVs and Level 2 EV Chargers).

(AdobeStock_288638641)

## Electric Generation:

If you follow how electricity is being generated in New England, you are seeing a continuous increase in the amount of renewable energy in the mix. We expect this trend to continue as more large-scale solar PV and off-shore wind turbine projects are installed. This means that the renewable electricity we use in our homes and businesses will continue to be an important and growing part of the New England power supply mix. So, what can we do to encourage the development of more green energy?

- **Good:** Support the continued gradual increase in renewable energy.
- **Better:** Join New Hampshire Electric Co-op's Renewable Choice program and purchase "blocks" of renewable energy credits for a monthly fee as low as three dollars. These REC purchases support the development and operation of renewable energy from local solar and wind facilities.
- **Best:** Install solar PV on your home and sell excess capacity to NHEC at net metering rates. Visit www.nhec.com/solar-net-metering for details.

(AdobeStock_366215509)

## Homes and Buildings:

Most New Hampshire homes and buildings are heated with fossil fuels. But increasingly, we're seeing more and more property owners installing highly efficient heat pump technologies, including heat pump water heaters and air source heat pumps to heat and cool. A typical oil boiler is about 86% efficient. A propane furnace is about 95% efficient, while an air source heat pump is more than 250% efficient! They're a great way to heat and cool a home for most of the year. For the very coldest days, using the existing oil or propane heating systems still works best. What else can we all do to make our homes or businesses greener?

- **Good:** Hire a professional to tune up your heating system every year.
- **Better:** Replace all lights with LEDs, and buy ENERGY STAR appliances when purchasing new ones (Check NHEC.com for available rebates).
- **Best:** Hire a professional to perform an energy audit on your home or business to identify ways to save energy while providing a list of recommended improvements. Consider installing heat pump systems for water heating and HVAC. Visit www.nhec.com/save-energy to see if your home qualifies for an audit and weatherization, or an incentive for heat pumps.

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We hope you will see our ad here on this page, in this edition of the *Green Energy Times,* and check off as many "Go Green in 2022" ideas that you can. As 2021 comes to a close, all of us at the New Hampshire Electric Cooperative wish all of the *Green Energy Times* readers and our NHEC members a very happy, healthy, safe and green New Year!

*Some Helpful Links:*

*ISO-NE: https://www.iso-ne.com/*

*Electric Suppliers: https://www.puc.nh.gov/Consumer/energysuppliers.htm*

*ENERGY STAR Products: https://www.energystar.gov/*

*Federal tax Credits: https://www.energystar.gov/about/federal_tax_credits*

*NHSaves: https://nhsaves.com/*

*NHEC: https://www.nhec.com/*

*Tom Belair is a member of the Energy Solutions team at New Hampshire Electric Cooperative, a member-owned electric distribution co-op serving 85,000 homes and businesses in 118 New Hampshire communities.* ♻

# Community Solar Opportunities for Brattleboro Affordable Housing

## *Affordable Housing Provider, Brattleboro Housing Partnerships, Reduces Operating Costs via Solar Net-Metering Agreement*

*Ajah Tier*

At the end of October, 2021, Norwich Solar, as part of its Community Impact Group, announced the start of construction of a Community Solar project in Clarendon, VT with Brattleboro Housing Partnerships as the dedicated net metering customer. The Clarendon project will provide solar net metering credits to Brattleboro Housing's facilities, providing BHP with savings of over $500,000 over the 25-year term of the Net Metering Agreement.

*Brattleboro Housing, Brattleboro, Vermont*

*Brattleboro Housing Partnerships Team. (Images: Norwich Solar)*

This Clarendon project is one in a series of community solar projects for low and moderate income (LMI) housing facilities that Norwich Solar has completed in the last several years through its Community Impact Group program. The Group links mission-minded investors with high impact projects that generate broad benefits to local communities, such as economic development and greenhouse gas reductions. These Norwich Solar projects -- totaling over $10M in impact investment -- will generate over $30M in solar net metering credits and $3M in direct savings for LMI housing and support facilities in Vermont.

The Clarendon project is expected to generate approximately 1,000,000 kilowatt hours a year of clean renewable electricity that will be fed directly into the Green Mountain Power electric grid. According to the US Environmental Protection Agency's estimates, that amount of energy is enough to power approximately 130 homes and is the equivalent of taking 154 passenger vehicles off the roads for a full year.

Dating back to 1962, Brattleboro Housing Partnerships has had a mission to ensure the provision of quality, affordable housing opportunities in viable communities for lower income households. The solar Net Metering Agreement will deliver significant financial savings to BHP and help them in accomplishing this mission. There were no upfront costs for BHP and by enrolling in the community solar project they will receive net metering credits on their Green Mountain Power electric bills for all of the renewable energy generated by the solar array. The funding for the project was provided by a solar investor through Norwich Solar's Community Impact Group. Once the project is completed it will be operated and maintained by RunTime Solar, a subsidiary of Norwich Solar, with no ongoing cost attributable to Brattleboro Housing.

Projects like this bring investment, jobs, and more local clean electricity generation into the state. Vermont currently generates the least amount of electricity of any state, both on a percentage basis (less than 43% of the electricity used in the state is generated there) and on an absolute amount (less than half of any other state) -- despite having the second most land per capita of any state east of the Mississippi River. Vermont's high reliance on out-of-state energy is a $2 billion per year opportunity (Vermont imports ~$3B of energy each year) to bring jobs and energy independence to the state. Producing more clean energy here at home in Vermont helps us all in our fight against global climate change.

Learn more at: Brattleboro Housing (brattleborohousing.org), Norwich Solar (norwichsolar.com/what-is-community-solar/) and RunTime Solar (runtimesolar.com).

*Ajah Tier is the marketing coordinator for Norwich Solar, tier@norwichsolar.com.* ♻

*Brattleboro Housing Partnerships solar array in Clarendon, Vermont. (Norwich Solar Engineer, Nathan Billings)*

MANY THANKS
TO OUR SPONSOR:

RUNTIME SOLAR

# Danville School to Benefit from Local Solar – Right Next Door

*Ajah Tier*

Continuing its 10-year focus of providing solar power projects to Vermont schools, Norwich Solar is pleased to announce that the Danville School, Cabot High School and Twinfield Union School will be receiving net-metering credits from a 500-kilowatt solar project built next to the Danville School. The solar project will further enable the schools' support of renewable energy and associated educational opportunities for students. Danville resident Doug LaMothe is hosting the array. Installation of the project will be completed this year.

The schools are enrolled as customers of the project through a Net Metering Agreement. This agreement provides the schools long-term savings with no upfront costs or operational obligations. The net metering credits generated will be applied to the three schools' Green Mountain Power electric bills each month, and will save approximately $500,000 in electricity costs over the 25 years.

Mark Tucker, Superintendent at the Caledonia Central Supervisory Union stated, "Danville, Cabot and Twinfield Schools are pleased to be in partnership with Norwich Solar and to be sharing the output of a solar farm with their sister schools in Caledonia Central SU. All three schools had looked into solar as an energy source in the past. Those past investigations had always floundered when it came to answering the question of siting: 'Which part of the campus was best suited for a solar array? Should we put it on the school roof? Can we put it on the roof?' Net metering resolved the siting question for us. When presented with the opportunity to garner the financial benefits of solar by participating in a planned solar farm to be built in Danville, with no upfront investment to the school districts, the respective Boards all saw this as a deal too good to pass up. We look forward to the Danville Solar project coming online so we can start saving money on the electricity costs in these three Districts, savings that will be passed on directly to our taxpayers in the form of reduced energy costs for the three schools."

*Norwich Solar construction manager, Parker Hatch, and installation crew on site in Danville preparing posts and racking for the panels (November 18, 2021 - Danville, Vermont)*

Norwich Solar in partnership with and financing from Mascoma Bank is currently completing construction of the array. This type of public / private partnership leads to more local economic development by leveraging federal tax dollars into the Vermont economy. The clean energy generated from the solar project will be fed directly into the Green Mountain Power electric distribution system which benefits all Vermonters, and the Renewable Energy Credits (REC's) produced by the solar project will be transferred to the utility helping Vermont achieve its in-state renewable energy goals.

Vermont currently generates the least amount of electricity of any state (less than half of our electricity is generated in-state) and imports greater than $2B worth of energy each year. The school's support of projects like this- grow local investment, create local jobs, and generate more local clean electricity.

RunTime Solar, a division of Norwich Technologies, will be providing operations and maintenance over the life of the project.

For more information contact Ajah Tier at tier@norwichsolar.com. ♻

### Danville, Cabot and Twinfield Schools Partner with Norwich Solar for a 500kW DC Solar Project

The total solar array size is 500kW DC.

Based on EPA calculations for ISO-NE, the array will offset 448 tons of carbon in the first year of operation, and will continue offsetting carbon for its 30 years of operation.

Regarding efficiency and sustainability efforts at the schools:

- Twinfield Union, replaced their fluorescent lighting in a main hallway and in the gymnasium with LED lighting, and put the hallway lights onto sensors so they turn off in banks if no one is in the hallway. They also replaced a couple of ERU's in the heating system with new units that are more energy efficient. This was done with the support of Efficiency Vermont, with a grant that covered almost 100% of the project cost.
- Danville School last fall renovated their ventilation system in response to the pandemic, and every new component in the system is more energy efficient. Efficiency Vermont funded most of this project. They are looking forward to restarting a failed wood chip heating plant that is being completely rebuilt, sometime after the holidays.
- They also have additional projects in the works at other schools that are awaiting release of a second round of ventilation improvement funds that will be managed by Efficiency Vermont.

# Considering Solar Installations for New Homes?

## Solar Electric and New Construction - Sizing Considerations

*George Harvey*

*Home with solar system by Maine Solar Solutions. It has an 8.01 kW array consisting of eighteen 445-watt REC solar panels with one SolarEdge SE10000H-US inverter. It is designed to produce 10,145kWh per year. (Courtesy photo)*

When homeowners consider installing a solar electric system on an existing home, they start off with one significant advantage – they already know their homes electricity consumption. In a building that has been occupied, the amount of electricity used has been recorded, measured in kilowatt-hours (kWh) per month. And unless there is some other change also going on at the same time, such as installation of heat pumps to replace an old oil furnace or the purchase of an electric car, the electricity production requirements for an optimal solar system are pretty much dictated.

Designing a solar electric (PV) system for a new house is a somewhat different experience. It is not usually possible to know exactly what the new home's electricity consumption will be. If a solar electric system is being designed to offset all of the home's electricity consumption, we will need to know how much electricity is to be used not just for lighting, but also for cooking, space heating, water heating, and a variety of other purposes.

The size of a house is a factor to be considered. The number of adults and children in the family are a factor. The lifestyle people live is also an important factor.

Sam Zuckerman of Maine Solar Solutions (MSS) gave us some insight into the approach his company uses with new construction customers. Since they do not know exactly what the home's electricity consumption will be, they start with the data that is available, including house plans, elevations, and site plans. This allows them to determine the maximum number of panels that will fit on the roof. They then present a proposal with three different system sizes: a maximum system size, a mid-size system and a smaller more conservative system size.

"Our goal is to educate our customer so they are making an informed decision," Zuckerman said.

The customer can choose to be conservative and install a smaller system designed for expansion or they can go with a larger system and adjust their electricity consumption to use of the available production.

Financing of the new solar system should also be considered. Federal tax credits and other financial incentives may be in place that are scheduled to be reduced or disappear, and obviously, it is best to keep these dates in mind. Clearly, it would be better to install a larger system that can take advantage of a subsidy than to install a smaller system that might not have a subsidy available when it is expanded in the future.

Also, it is a good idea to consider having the cost of a new house include the solar system when getting a mortgage. It is possible that the financing for a PV system will be considerably less expensive if it is included in the larger mortgage.

Zuckerman also pointed out that there are several considerations for designing a system that are not usually included in home owners' thoughts. One thing to think about is the aesthetics of the system. Some people rather dislike the look of traditional solar panels that they typically see and may find that all black solar panels are more pleasing to look at.

Efficiency is another thing to consider. Solar panels do not all operate at the same efficiency. And, of course, they do not all cost the same. Some do better than others at extreme temperatures. Finding the best value on solar panels will require keeping all these factors in mind. It is not a job that most customers are prepared to tackle alone.

From the customer's point of view, the best thing to do is to learn as much as possible before investing in a solar system. An approach to PV system sales and design like the one that is practiced by Maine Solar Solutions is one that is itself designed to make the solar design as clear as possible to customers. ♻

# Let It Snow: Solar and Winter Weather

*Rachel Gentile*

Resonant Energy is a Massachusetts-based solar provider. Here, questions about how changing weather and cold winters affect solar production, are above and beyond the most common item we hear from clients. In fact, we get questions about weather-related issues almost as much as people from the Northeast complain about the weather! Now that the days are getting shorter and growing ever chillier, we want to take some time to answer these recurrent and important questions about how winter weather has impacts on your solar energy system, and explain how we use past data to account for changing weather in our analysis process.


*For the record, unless you plow your roof, you don't necessarily need to clear your solar panels.*

## Seasons:

Every Northeasterner knows that the cold is approaching when the sun starts setting earlier, since the farther north you live, the shorter your days are in the winter. Summer is the best season for solar production because the days are longer, meaning that solar panels are working for more hours of the day than they do in fall, winter and spring. Though the cooler months have fewer daylight hours, they make up for some of this loss with greater production efficiency, due to the impact of temperature on output.

## Temperature:

Photovoltaic (PV) solar harnesses energy from the light of the sun—not the heat—meaning energy is produced even in the bitter-cold Northeastern winters. Temperature does not affect the amount of energy the solar panels receive, but the panels are more efficient at converting that energy into electricity when it's cold out and they are less likely to surpass their peak operating temperature.

Electricity is produced when light hits the panel and the electrons in the panel move from a "resting" state to an "excited" state. When the panels are cold, there is a greater difference in energy between the excited state and the resting state, which allows the panels to convert the energy into electricity more efficiently.

Panels are typically tested at 77°F. When the temperature is higher, the panels will be less efficient and if the temperature is lower, the efficiency will be greater. Much like your car heats up when it's parked in the sun, solar panels can get very warm throughout the day, but if the air is cold, it can cool the panels and increase efficiency. Therefore, the best days for solar panel efficiency are cold, sunny days such as those we typically see in late fall and early spring.

## Snow:

A light dusting of snow does not significantly prevent light from reaching the panels. As more snow starts to accumulate and cover the panels, it can prevent electricity production until the snow melts or slides off. Luckily, if even part of a panel is exposed, it can still produce electricity.

***[Editor's note: this is only true if you have micro-inverters on your system. Older systems did not and need to be free of any shading, including snow. Off-grid systems probably would do best to keep all snow cleared from the array. And with any solar system, the reason to have them is to produce electricity. This does not happen when covered with snow]***

It may sound counterintuitive, but snow can actually be good for solar production. When the snow melts or slides off, it carries away dust or dirt that may have accumulated on the panels. Clean panels produce more electricity than dirty ones, so the occasional rain or snowstorm is a good thing. Sometimes when snow slides off of sloped arrays, it all slides off in one large sheet so don't be alarmed if you hear a loud crash after a snowfall—it's just mother nature cleaning.

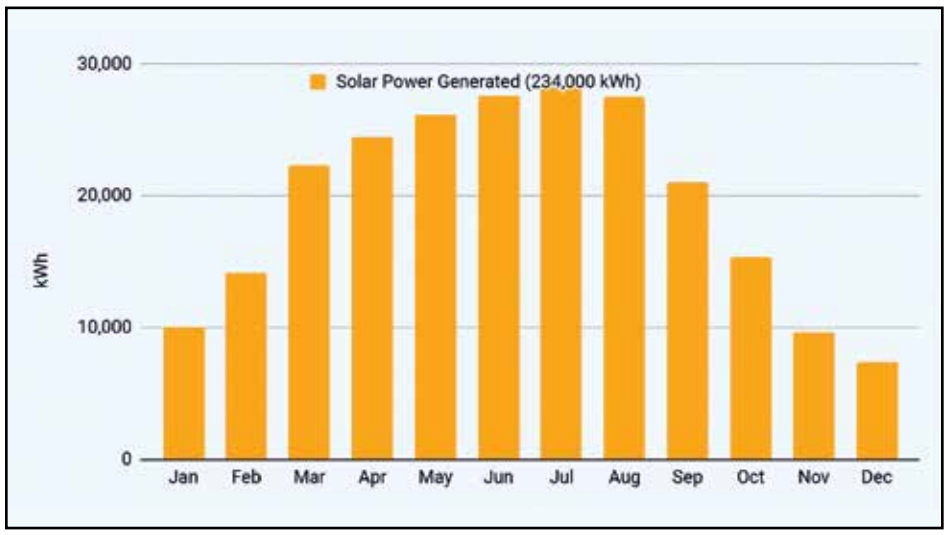
## Rain and Clouds:

As we've already discussed, the best weather for solar panels is clear, sunny skies and cooler air, however, solar will still produce energy on rainy or cloudy days. On very cloudy days, panels produce anywhere between 10-25% of the energy that they would on a sunny day. The water droplets in clouds and rain scatter light, meaning that less energy reaches the panels and can be converted into electricity. Though we wish every day was bright and sunny, we know that weather varies in the Northeast and the occasional cloudy day won't hurt your solar production in the long run.

Weather in our region may feel unpredictable, but when we at Resonant Energy create the production estimates that go into our project proposals, we put a lot of thought into making them as accurate as possible. Our software utilizes a dataset with 25 years of local weather data to predict how much energy your system will produce each year so you can feel confident in your investment. There are many variables that contribute to the amount of energy your solar panels will produce but regardless of your day-to-day production, solar is a long-term investment that will provide value for years to come.

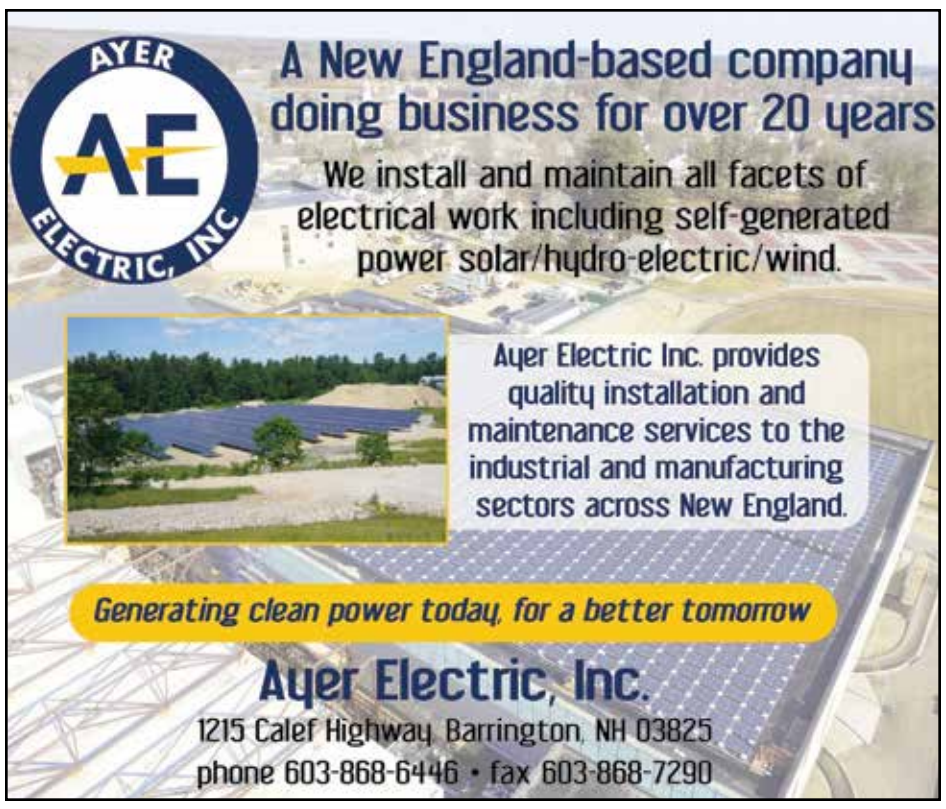
*Rachel Gentile is a Marketing Associate at Resonant Energy, a Boston-based B-Corp committed to building wealth in under-invested communities through solar power. Learn more at www.resonant.energy.*

*Reprinted with permission. The original blog is at https://bit.ly/ResonantEnergySnowandSolarPanels.* ♻




*Solar power generation varies seasonally, with the highest production occurring in the summer months when daylight hours are longer. (Images: Resonant Energy)*





# Green Power Series: Solar Farms in the Northeast

## Part 2: Bolstering Economic CSF Investment for Maine and Vermont

**(This is the second in a series of *Green Energy Times (G.E.T.)* articles that focus on community solar farms (CSFs). The first, in the October issue, was a general overview of CSFs, while this one covers several CSFs located in Maine and Vermont. The next issue in February 2022 will cover New Hampshire and New York.)**

*Toby Martin*

*Long Pond solar farm is located in Southwest Harbor on Mount Desert Island, Maine. It is 840KW and sits on an old landfill. (Revision Energy)*

Community solar farms (CSFs) happen when a group of people invests and shares in the benefits of a solar array where solar power is generated for investment or subscription. Investors purchase percentage shares of a solar generating array, while subscribers pay a monthly bill for their power usage, usually at a 10% to 15% savings below the public utility's standard offer rate.

### Maine

Maine has several companies with CSF sites around the state that are essentially independent power providers for investment or subscription. One of these, ReVision Energy, handles all aspects of establishing and maintaining their CSFs, which include selecting a site, design, licensing, construction, legal work, and all operational requirements once the system goes online. All of these are governed by state regulations, which are guided and enforced through statutes which fall under the jurisdiction of the state legislature and the Public Utilities Commission (PUC). When solar farms began to operate in Maine, state regulations allowed up to ten owner-members to participate in one system; today up to 100 are allowed, depending on the system's size and energy production capability.

ReVision, a Maine energy company with headquarters in South Portland, which also operates in Massachusetts and New Hampshire, began in Maine, and built its first CSF operation in 2014 for the ten shareholders of the Sunnycroft Farm CSF in the town of South Paris with a $40,000 startup grant from Efficiency Maine. Sited on the roof of an old chicken barn, it is a 51-kW system that provides electricity for the homes of its nine offsite owner-members.

Another nine-member ReVision CSF followed with the Edgecomb Community Solar Farm Association of Lincoln County. Each of them contributed $10-30,000 per investor over 25 years, which they planned to meet with a 10-year payoff date for the 182 solar panel system.

A more recent ReVision venture, the Long Pond CSF, is located in Southwest Harbor in Mount Desert Island. In keeping with ReVision's goal to locate its CSFs on otherwise "undesirable" land not in conflict with environmentally important uses such as farming or forestry, Long Pond is sited on a decommissioned and unserviceable landfill owned by and leased from Eastern Maine Recycling.

In 2019 the Maine legislature expanded a CSF's power generation limit to allow generation of up to 5 megawatts (5,000 kilowatts), able to power 600 to 700 Maine homes, and which rapidly attracted out-of-state investment from as far away as California, and the Public Utilities Commission's list of approved CSF businesses recently stood at 231, of which only about 30 are based in Maine.

ReVision's more recent larger scale commercial solar farms include the 792 kW Streamside CSF in Pittston, the 1,950 Carravale CSF in the town of Knox, and the 839 kW Long Pond CSF in Southwest Harbor, and they have also developed another dozen in the 50-kW range. Future plans include adding 13 more CSF projects in Maine by 2023, which will generate an estimated 44 megawatts of power.

Sundog Solar, based in Maine's midcoastal town of Searsport, building on 12 successful years of experience installing solar-oriented systems for homes, municipalities and nonprofits, has recently begun its expansion into investment-based CSFs by developing partnerships that will focus on Level 1 and Level 2 designs. Maine regulations allow Level 1 CSF systems to generate up to 25 kilowatts, and Level 2 rules allow systems to generate between 26 kilowatts and 2 megawatts.

Plans are under way to develop Sundog's first CSF investor project, using Sundog's collaborative partners model, to be located in a coastal community on town land. It will combine two stages of development: a 300-kilowatt municipal utility and an added system to provide power for up to 40 community investor subscribers to participate. Once all of the necessary agreements have been made among the parties involved, the project will be publicized.

*The Springfield Edgewood solar farm in Springfield, VT is a 788kW system consisting of 2,160 375-watt panels. (Norwich Solar)*

### Vermont

Like Maine, Vermont has adopted CSFs, because innovative CSF developers have found that they can engineer their solar farms to suit the needs of the groups and organizations who hire them.

Norwich Solar has its headquarters in White River Junction. It also has an office in Brunswick, ME, and covers New Hampshire, serving clients who value environmental, social and economic objectives. Their clients include nonprofits, municipalities, schools, and hospitals. One of those clients, Terrace Communities, serves three assisted living communities in Manchester, White River Junction and Woodstock. The commercial CSF system is built of 2,160 345-watt solar panels.

Another Norwich Solar client in Vermont is Springfield Edgewood, located in Springfield, duplicated the design and power of the Terrace Communities system with 2,160 345-watt solar panels that provide net- metered power for low income and public housing in Vermont and New Hampshire.

Norwich Solar's collaborative, creative approach to their work in Vermont is reflected in the Thetford Community Solar Farm in Thetford, where Norwich Solar teamed up with Wolfe Energy to create a dual-use system of 585 375-watt solar panels serving two nonprofits, the Thetford Library Federation and the Thetford Water Co-op, as well as local community members who were able to purchase three-panel shares of the system to offset their long-term energy costs. The system is estimated to save about $54,000 in energy costs annually, as well as offsetting 210 tons of CO2 each year.

Another notable Vermont energy corporation, Encore Renewable Energy, a certified B corporation, partners with organizations to provide community scale solar projects sited on old municipal landfills and gravel pits. The town of Jericho and Vermont Electrical Cooperative have partnered with Encore to develop two projects: a 2.3-megawatt system built on an unused, closed landfill, and a 2.1 MW system on a former gravel pit. When combined with two other projects, the system will add nearly 8 megawatts for distribution. Along with that, the system also includes a 4–8-megawatt lithium-iron solar storage component at the landfill site.

*Toby Martin lives in Islesboro, ME, where he works locally and statewide to strengthen Maine's clean energy sustainability. A founding member of the Islesboro Energy Team and the Islesboro Energy Committee, he also coordinates the Islesboro Energy Conference, and he contributes to* Green Energy Times *as a writer and member of its Maine distribution team.* ♻

# Goosebay Sawmill and Lumber: Solar and So Much More

*George Harvey*

*Left: Retail barn with rooftop solar; below: Pine barn with rooftop solar. (Photos: Goosebay Sawmill and Lumber)*

Goosebay Sawmill and Lumber in Chichester, NH has been in continuous operation since it was started in 1978 by Carl Mahlstedt. Goosebay is family owned and operated. Son Carl runs the daily operations with his dad, and family member Lydia West is the CFO.

Having been very hard hit by the 2008 recession, the company wasn't sure what to expect when Covid-19 hit the country. They immediately reached out to the NH Small Business Development Center (SBDC). The SBDC provides guidance and counseling to businesses free of charge. They help to pair up businesses with available programs to help them improve their operations.

As we all know, the pandemic resulted in a dramatic increase in the demand for lumber. Goosebay saw an increase in customers looking for a variety of woods. The demand came first from people wanting eco-friendly wood for raised garden beds, then from do-it yourself homeowners wishing to make improvements and craftspeople looking for materials for woodworking projects.

Goosebay continued their relationship with the SBDC, which offered help in a variety of areas. One suggestion they made was to take advantage of a Level II Energy Audit. Resilient Buildings Group performed the audit and Energy LB was the consultant during the audit.

The audit directly addressed Goosebay's main Retail Barn, but also included general conversations regarding improvements that could be made both in the Sawmill and in the Pine Barn, which houses some retail space (mainly for pine lumber!), a large planer, kiln, and cabinet shop.

Updating all the lighting to LEDs was an easy decision to make. Another easy clean energy decision was to convert the sawmill from diesel power to electricity. Discussions of heating options were more complicated. The main areas heated are the Retail Barn and the cabinet shop. The Retail Barn is currently heated with radiant heat in the concrete floor. It's a very efficient heat for the space. The large overhead door is often open in order to move lumber in and out of the barn. In the colder months, the heated mass of the concrete floor makes the heat recovery much faster. Additionally, any system installed must be dust-tolerant.

Goosebay explored air-to-water heat pumps that would allow them to continue using their radiant heat. The technology needed for this type of commercial system exists in the world, but is not readily available in the US. The recommendation from the energy audit was to wait a few years for the technology to catch up.

Expecting a big increase in demand for electricity as a result of converting the sawmill and heating systems to clean energy, Goosebay decided to explore installing a solar array. Using the expected future demand, as defined in the Energy Audit, they asked for bids from a few companies. ReVision Energy was chosen to install the arrays.

Lydia West, as Goosebay's CFO, was able to find the resources they needed to help finance the solar arrays. She did not expect the project to pay off, initially, but soon found that it would be, in her words, "financially net-positive after year one."

Goosebay now has two rooftop solar systems. One on the retail building has 126 Renewable Energy Corporation 330-watt panels, and one on the pine barn has 111 panels of the same type. Each system has a SolarEdge inverter and is separately metered.

According to Brittany Angelo of ReVision Energy, the combined capacity is 78.2 kilowatts, and the systems are expected to produce about 96,034 kilowatt-hours of electricity per year. They will offset about 101,634

*Cont'd on p.18*



# Squam Lakes Natural Science Center Goes Solar

In 2016, when Squam Lakes Natural Science Center updated its Strategic Plan, an ambitious "50 by 30" pledge was made. The pledge was to achieve 50% of its energy consumption from renewable sources by 2030. The Science Center has taken several steps in that direction over the last five years but is ready to make a huge leap to surpassing its goal with a new solar array currently under construction.

The full project is a 139kW solar photovoltaic array (380-plus panels), which will be constructed in two phases. The completed project is sized to generate enough power to offset nearly all of the Science Center's electric needs. The PV project could save approximately $26,000 in electricity costs annually and over 250,000 pounds of $CO_2$ emissions. It will be paired with educational interpretation to teach visitors about renewable energy and the climate crisis.

"We know that climate change is a worldwide catastrophe," said Science Center Executive Director Iain MacLeod. "We hope that our initiative to go solar will help educate the public about clean renewable energy and to encourage others to take action."

*Squam Lakes Natural Science Center is on its way to achieving a goal of 50% solar by 2030. (Courtesy image)*

Phase one of the $375,000 project commenced in November 2021. Approximately 20% of the project's solar panels (totaling 24.82kW) are being installed on the roof of the Early Childhood Education Center, home of the Science Center's Blue Heron School, a nature-based Montessori early learning center for students ages 3 to 6.

The second phase is ground-mounted arrays to be placed around the main parking lots. Construction will begin when funding is in place – we hope later this winter. The Science Center just received a $75,000 challenge grant from an anonymous donor for the project and is looking to match that grant very soon. Potential donors are encouraged to contact Iain MacLeod at iain.macleod@nhnature.org. The Science Center is grateful to funding already received from Hypertherm Hope Foundation – Green Grants, The Samuel P. Hunt Foundation, and Trustee Emily Preston and her brother Andrew Preston for funding received to date.

Squam Lakes Natural Science Center worked closely with Ted Vansant of New England Commercial Solar Services, Mauchly Electric and Plymouth Area Renewable Energy Initiative (PAREI) on the design and installation of the project.

"Solar energy is an abundant source of emission-free power. We are proud to work with the Science Center to help them meet their carbon emission reduction goals," said Sandra Jones, PAREI Director. "Installing solar PV panels is one of the best steps an organization or family can take to combat climate change."

Learn more about the Science Center at nhnature.org; PAREI at plymouthenergy.org; and New England Commercial Solar Services at necsolarservices.com. ♻

# Will Nuclear Power Save the World?

*George Harvey*

## An old paradigm

The electricity most of us use comes from a system that was designed mostly over a hundred years ago. It was built around concepts that benefited customers of that time. It started with baseload power plants with transmission lines carrying the electricity to towns and cities where customers lived.

A baseload power plant is designed for efficiency of scale and operation. Many years ago, that meant it had to be as big as possible. Since any ability to ramp power output up or down quickly would cost a lot extra, the plants were designed to have constant output. With constant output, a baseload plant had to be sized to meet a demand that could be counted on always to be there. This is the base load, the lowest load that the grid would ever have over the course of time.

Since the baseload power plant was designed to cover the lowest load, any amount of electricity that would be in excess of that would have to come from other sources, all of which cost much more to run. They were load-following plants and "peaker" plants.

Baseload power plants were sited based on cost and access to resources they needed. Typically, they went up on inexpensive land at some distance from the market they served. They had to have access to fuel resources, which often meant that they needed their own docks or rail sidings. Also, they were often placed on bodies of water to take care of their cooling needs, which are great, because only about one third of the heat they produce could be used to generate electricity.

*San Onofre nuclear plant in 2007. Photo by awnisALAN (www.bit.ly/3x94I3S), CC-BY-SA 2.0 (www.bit.ly/ccbysa-2-0)*

Originally, baseload plants mostly burned coal. When nuclear reactors were brought online, starting in mid-century, they fit right in with what was the current paradigm of the time. The difference was that they produced nuclear waste instead of air pollution and carbon dioxide.

We might note for reference here that when the state of Vermont was looking for a contract to replace electricity it had been getting from the Vermont Yankee (VY) nuclear plant, the owner of VY made an offer that they said the state could not refuse. It was the equivalent of 6.5¢ per kilowatt-hour (kWh). The state immediately found cheaper renewable electricity.

## A new paradigm

By contrast, today the least expensive source of renewable power need not be large. Solar panels operate at the same efficiency whether they be in utility-scale arrays or on a residential roof-top. Significant amounts of electricity can be generated by solitary wind turbines.

Of course, there is a saying, "The sun doesn't always shine, and the wind doesn't always blow," which happens to fall into a range of unintentionally disingenuous to simply deceptive. The amount of electricity coming from a given solar array is really rather predictable and tends toward optimal in periods of light winds. And wind turbines do best when the sun is not shining brightest, so they complement each other. But more to the point, while a single wind turbine can be idled in calm weather, the wind never stops blowing over wider geographical areas.

We might ask whether the problem of variable output of wind and solar power is as big as the problem of inability of baseload power to follow loads. The answer to this can be seen in the relative costs of electricity from load following and peaking plants, on the one hand, and batteries, on the other. We could do a detailed analysis of this, but it is really not necessary because the utilities are showing the results of their own analyses.

A number of utilities are replacing plants powered by natural gas, which includes most load-following and peaking plants, with solar arrays and batteries. In one case, Entergy Mississippi is planning to replace older natural gas plants with solar and wind-power. In the case of Entergy Arkansas, a combined-cycle (base-load) natural gas plant it had planned will not be built, and the company will build renewable resources instead (KATV.com)(www.bit.ly/EAs-new-plan).

Comparing nuclear power with solar+storage

An article in *PV Magazine* in August compared the cost of two new nuclear reactors with a combination of solar photovoltaics (PVs) and battery storage that would replace them functionally, as dispatchable power sources running full time (www.bit.ly/PV-Mag-compare). The article is titled, "Solar challenging nuclear as potential climate change solution."

The author, who had some expertise in systems that include solar+storage (S+S), used actual costs for the Vogtle reactors that are being built in Georgia. The two reactors, which have been under construction since 2013, are expected to come online in 2022 and 2023, at a cost of roughly $30 billion, including $3 billion in finance costs. Their capacities will be 1,117 megawatts each.

The *PV Magazine* article calculates the cost of a solar array big enough to provide the same output as the nuclear reactors in the winter in Georgia. It assumes battery storage to supply the output of the nuclear plants for 16 hours, increased by 10% to be safe.

The author shows that the cost of the S+S system designed to replace the two new Vogtle reactors would cost a little less than $17 billion. That would represent a saving of about $10 billion, not counting finance costs.

*Cont'd on p.18*

# CRITICAL MINERALS - LITHIUM: PART 1

*Dan Antonioli*

Lithium-ion batteries are all the rage. Hardly a day goes by that you don't use them, hear about them, or see the word "lithium" on an electronic gadget or battery. Nearly every page of *Green Energy Times* has an advertisement, product, service, or policy that in one way or another relates to lithium-ion batteries or "lithium energy."

**But what is lithium?**

Its past, present, and more important its future? Now commonly referred to as a "critical mineral" for a renewable energy future, lithium is in high demand and experiencing an intense geo-political fight for its acquisition. Lithium ion is the new gold standard for battery storage and, like gold, it is coveted. Those who have lithium have power, literally, and we like our renewable energy power.

**Let's take a closer look at lithium**.

Lithium is an alkali metal and along with hydrogen and helium is one of the first "miracle elements" that came bursting out of nothing from the Big Bang. If you listen closely, you can hear lithium singing its praise, "I created myself. I invented myself. I'm special." For all of lithium's hubris, right now it's special, so much so we've put it on a pedestal, and here's why.

As an element, lithium holds the third spot on the periodic table. It's also a trace mineral that can be found in

*AdobeStock_271130707*

water, beer, sodas, seaweed, and common foods such as potatoes. Lithium is in your body and you can even buy it at your local health food store as a supplement known as "lithium orotate," which is supposed to help with mood stabilization and promote a sense of well-being. As a battery in your electric vehicle, it might also help with a sense of well-being in that it reduces range anxiety!

In higher concentrations lithium is used as a powerful psychiatric drug claimed to help with depression, suicidal tendencies, mania, and anxiety. Lithium, lithium carbonate, and lithium citrate are widely prescribed and have been used excessively, even with their known negative side effects. Lithium citrate was once even part of the mix of the popular soda 7-Up, which used to be called "Bib-Label Lithiated Lemon-Lime Soda." So once upon a time you could drink a Coca-Cola laced with cocaine and then sooth your nerves with a 7-Up! No wonder we're addicted to the stuff.

But most of us know lithium as the magical ingredient that powers our Smart Phones, laptops, off-grid batteries, EVs, electric bikes, calculators, and flashlights. More efficient and lightweight than the bulky batteries of the past, lithium-based batteries are mainstream, so much so that most consumer don't even know they're using them. Every supermarket around the globe that sells batteries most likely has lithium-ion batteries on their shelves.

Although a naturally occurring element, lithium accounts for only 0.002% of the earth's crust and is in limited supply. I use the word "supply" intentionally here because "supply" implies an anthro-centric assumption that something naturally occurring in nature is there for the human taking. Well, take it we have, and we're running out. Projections of the future availability of lithium vary wildly from "party over" by 2040 to "let's party" for the next 340 years.

But no matter how much you mine it, extract it, or brine it, lithium is getting used up, fast, and we need to think beyond it if we are going to have a stable renewable energy future. Don't be fooled by Elon Musk's cherubic grin when he extolls the wonders of the new and exciting lithium-iron-phosphate (LFP) batteries that will keep the price of a Tesla stable and the range long. But if "range anxiety" is such a problem, then perhaps every new EV should come with a pharmacological supply of lithium to ease the worry—same range, less anxiety, it will be the new "win-win" of the renewable energy future!

Lithium, or Li, is the third lightest element in the universe and was discovered in 1817 by Swedish chemist Johan Arfvedson when he found it in a piece of volcanic stone and isolated it as a salt. He named it after the Greek word "lithos" for stone.

## BATTERY REVOLUTION

When Sony introduced the first lithium-ion battery in 1991, we thought it was the best thing since the invention of sliced bread. Before there were "Smart Phones" there were cell phones, and the first ones were bulky, pineapple-sized units due mainly to their nickel batteries. With lithium-ion batteries, big cell phones morphed into sleek smart phones and digital technology got super thin and light. Lithium has thus become our special friend.

What is most interesting about lithium as an atomic element is that it is highly reactive and readily loses an electron to form new bonds and, thus, a positive charge. This charge in turn allows electricity to flow easily; it's as if lithium

*Cont'd on p.19*

# Grandpa's Knob Community Wind Project in Castleton, Vermont

*Reprinted with permission from https://grandpasknobcommunitywind.com/*

## RESTORING, HONORING HISTORY

In 1941, the world's first electric grid wind turbine sat atop Grandpa's Knob. Grandpa's Knob Community Wind (GKCW) is a proposed single wind turbine project to be sited in Castleton, Vermont just below the peak near where that first turbine sat.

## COMMUNITY ENERGY PROJECT

Like the 1941 turbine, GKCW's turbine will be interconnected with the local electric grid, providing wind powered energy to Vermonters as part of the state's renewable energy "Standard Offer" procurement program. Working with the community and the Select Boards, GKCW intends the project to benefit the local community, specifically the towns of Castleton, Hubbardton, West Rutland, and Proctor, with tax revenue and other benefits.

## SIMILAR HEIGHT TO EXISTING GRANDPA'S KNOB COMMUNICATIONS TOWER

Right now, there is already a 310-foot-high lattice television and communications tower on the peak. GKCW's 1.5 MW wind turbine, sited 110 feet in elevation below the knob where the existing tower is located, will measure 275 feet to the generator hub. The blades will sweep 143 feet higher than the hub.

The wind turbine will be manufactured by Goldwind.


*Photos provided courtesy of York County History Center*

The York County History Center has an online exhibit all about Grandpa's Knob wind turbines called *"Energy Awaits."* You can view it at www.bit.ly/NYHist1.

## NO NEW ACCESS ROADS

The site is accessible by an existing truck-ready gravel road that was constructed in 1941 to transport the original Grandpa's Knob wind turbine and that now services the communications tower.

## MEETS VT'S STRICT SOUND STANDARDS

A sound level of 50 dBA is considered "quiet," a normal conversation is in the range of 60 dBA, and most people watch television at a sound level of 70 dBA. Sound from the turbine's operations will be regulated by Vermont's strict wind energy sound standards which require a maximum sound level of 42 dBA between 7 AM and 9 PM, and 39 dBA between 9 PM – 7 AM, at a distance of 100 feet from the residence of a non-participating landowner.


## MORE INFO COMING

Like the existing communications tower there now, the wind turbine will be visible from certain viewpoints in Castleton, Hubbardton, West Rutland, and Pittsford. A comprehensive analysis of the turbine's visibility is underway and will be shared as soon as it is available. ♻

*Many thanks to our sponsor:*

GRANDPA'S KNOB COMMUNITY WIND

# FEDERAL

## FEDERAL INVESTMENT TAX CREDIT

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

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

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

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

## USDA RURAL DEVELOPMENT PROGRAM

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

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

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

## BIOREFINERY ASSISTANCE PROGRAM

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

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

• Increase energy independence

• Promote resource conservation, public health, and the environment

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

• Create jobs and enhance economic development in rural America

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

# REGIONAL

## NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

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

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

• have an annual budget up to $100,000

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

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

# VERMONT

## CLEAN ENERGY DEVELOPMENT FUND

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

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

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

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

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

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

• **Windham County**

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

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

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

### Other Utilities Heating Offers

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

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

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

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

### Tier III programs

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

## EFFICIENCY VERMONT

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

### Lighting

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

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

### Weatherization

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

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

### Appliances (must be ENERGY STAR)

• Dehumidifiers: $25 - $40 rebate

• Clothes Dryers: $200-$400 rebate

### Heating/Cooling/Water Heating

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

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

**Heat Pumps:**

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

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

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

• 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.

### Residential New Construction

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

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

### Other Opportunities to Save

• Home Energy Loan – finance up to $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.*

# NEW YORK

## RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSERDA

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

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

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

### Extended Federal Tax Credits for Renewable Energy

Good news for renewable energy and climate action!

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

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

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

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

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

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

### National Grid: Electric Vehicle Charging Station Make-Ready Program

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

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

# NEW HAMPSHIRE

## Renewable Energy Incentives Offered Through the NH Department of Energy

NH DOE: Get up-to-date information at: www.bit.ly/GET-NH-1

## Commercial Solar Rebate Program

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

Incentive levels for PV systems are as follows:

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

Contact: www.bit.ly/GET-NH-2 or at (603) 271-3670. Website: www.bit.ly/GET-NH-1

## Residential Solar/Wind Rebate Program

-Currently closed, this program offers rebates to qualifying NH residents who install photovoltaic (PV) or wind turbine electrical generation systems. Rebate levels are $0.20 per watt of panel rated power up to $1,000, or 30% of the total facility cost, whichever is less. ***Check for updates for ALL Rebates at www.bit.ly/GET-NH-1.***

## Residential Solar Water Heating Rebate Program

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

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

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

## Residential Wood Pellet Boiler/Furnace

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

Contact: www.bit.ly/GET-NH-3
Website: www.bit.ly/GET-NH-1 for more information and current program status.

## LOCAL INCENTIVES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## NH Home Performance with ENERGY STAR

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

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

## NH ENERGY STAR Homes

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

## NHSaves Residential ENERGY STAR ® certified Products Program

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

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

## NHSAVES Online Store

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

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

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

**NHSaves:** nhsaves.com

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

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

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

## Other NH Electric Utility Programs

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

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

## Business Programs

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

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

## NH Weatherization Assistance Income-Eligible Programs

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

Visit 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**

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# MAINE

## EFFICIENCY MAINE

Efficiency Maine is a division of the Maine Governor's Office of Energy, provides information and rebate opportunities online and by phone (efficiencymaine.com, 1-866-376-2463) for Maine homeowners, businesses and municipalities.

**Rebates** included through Efficiency Maine's programs include a wide variety of approved :energy efficient devices and services that cut energy costs and lower greenhouse gas emissions. Standard rebates range from $50 to $7,500 or more, available through pre-approved businesses, dealers and contractors. Low income eligibility options are available.

**Appliances:** Clothes dryers, clothes washers, dehumidifiers, dishwashers, freezers, refrigerators, retail store discounts, room air purifiers.

**Weatherization, HVAC, Inulation:** Air sealing and energy assessment, circulator pumps, electric vehicles, gas heaters and boilers, geothermal systems, heat pumps, heat pump water heaters, gas heaters and boilers, insulation, pellet boilers

**Financing:** Energy upgrade loans, up to $15,000 at 4.99% over 10 years.

**Federal Tax Credits:** Also available for EV chargers; gas, propane and oil furnaces, boilers and heaters; pellet and wood stoves; solar systems (no cap, 26%),

**Learn more at efficiencymaine.com.**

## GREEN ENERGY TIMES' TEAM

*Cont'd from p.2*

reaching 1000 miles, still with over half a tank of gas left from when we bought it."

***G.E.T.* comments:** Russ Lanoie has reduced his emissions and pollution from heat, hot water, electricity, and transportation. Having got to a pretty good point, he has gone further. He is getting the word out to family, friends, and even strangers by distributing G.E.T.

*Lanoie's Kia Niro plug-in hybrid was purchased in July, 2021. The gas tank has only been filled once, giving 171 miles to the gallon. The car plugs into an existing 110V outlet that provides eight amps and keeps the car totally charged overnight.*

In our next issue, we will bring our readers more about how those who work to *G.E.T.* the word to you, and who work to sustain and heal the planet for a safe and comfortable future. ♻

# Historical Dan and Whit's Store Looks to the Future with Energy Efficiency

*Meghan Chambers*

Like many country stores in Vermont, Dan and Whit's is a community hub. Operating in Norwich for more than 150 years, Dan and Whit's is where neighbors pick up necessities – Dan and Whit's classic motto is "If we don't have it, you don't need it." It's a place to go to see a familiar face or catch up on the latest local news. It doesn't just serve the community, it's a part of it.

Owner Dan Fraser and his team work hard to maintain this local institution. They keep it open from 7 a.m. to 9 p.m. every day of the year except two; Thanksgiving and Christmas when they lock up at noon. They stock their shelves with the basics, and with special customer requests. They employ about 90 local high school and college students during the course of a year. And they frequently support local nonprofits, including their biggest fundraiser "The 19 Days of Norwich (and beyond), 1% for the Haven," benefitting The Upper Valley Haven food shelf and homeless shelter.

*Historic Dan and Whit's general store, a landmark in Norwich, Vermont, looks to the future with continued investment in renewable energy and efficiency. (Courtesy images)*

Rooted in the community for a century and a half, Dan and Whit's is looking to the future by investing in energy efficiency upgrades.

"We are investing in efficient upgrades because of climate change," said Dan Fraser. "We must change our ways as a society."

Dan and Whit's took advantage of a limited-time offer from Efficiency Vermont, in partnership with the Central Vermont Regional Development Corp. The program helped vital businesses move ahead with planned energy efficiency upgrades that may have been delayed due to impacts of the COVID-19 pandemic. They are working with Efficiency Vermont experts to move their planned upgrades forward, which include upgrading their heating and cooling system to cold- climate heat pumps.

While the limited-time offer Dan and Whit's took advantage of has now closed, other incentives and technical support are still available to businesses through Efficiency Vermont. The purpose is to help businesses achieve their energy efficiency goals to reduce carbon emissions, improve comfort, and lower operational costs.

Fraser's advice to other country store owners in Vermont who are considering efficiency upgrades: "Do it now! Efficiency Vermont walks you through the process, making it very easy. The financial incentives are significant, and the energy you save will cover the cost of the project over time. Climate change is real – we must do this. The sooner, the better."

The first step toward a more sustainable business is to contact Efficiency Vermont. Energy advisors work with businesses to look for cost-effective energy savings opportunities, leverage incentives and other financial resources, and find qualified contractors to get the work done. Call Efficiency Vermont at 1 (888) 921-5990 or visit www.efficiencyvermont.com.

*Reprinted with permission from the October 14, 2021 Vermont Retail and Grocer Association's blog found at https://vtrga.org/news/historic-dan-and-whits-looks-to-the-future-with-energy-efficiency*

*Meghan Chambers has worked for Efficiency VT, based in Burlington, for ten years. Chambers is a customer engagement leader and helps small- and medium-sized business to identify energy efficiency opportunities.* ♻

## Goosebay Sawmill

*Cont'd from p.13*

lbs of carbon dioxide per year, which is the equivalent of taking ten passenger cars off the road.

Goosebay has not stopped. They continue to look for more ways to decrease their carbon footprint. They are watching the development of electric vehicles and are looking forward to incorporating them into their fleet.

Goosebay Sawmill sells over seventy species of hardwood and softwood sourced both locally and from around the world. (goosebaylumber.net) ♻

*Top: LED lighting inside the retail barn; bottom: electric sawmill at Goosebay Sawmill & Lumber*



## Will Nuclear Power Save the World? – *Cont'd from p.14*

While that sounds impressive, the article underestimates the benefits in a number of respects. Here are some:

Output of the S+S system is calculated to be the same as nuclear in the dead of winter. The nuclear plant's output will be constant year-round, but the S+S system will produce far more electricity nearly all year than in the dead of winter. The value of the extra electricity from S+S is not accounted for.

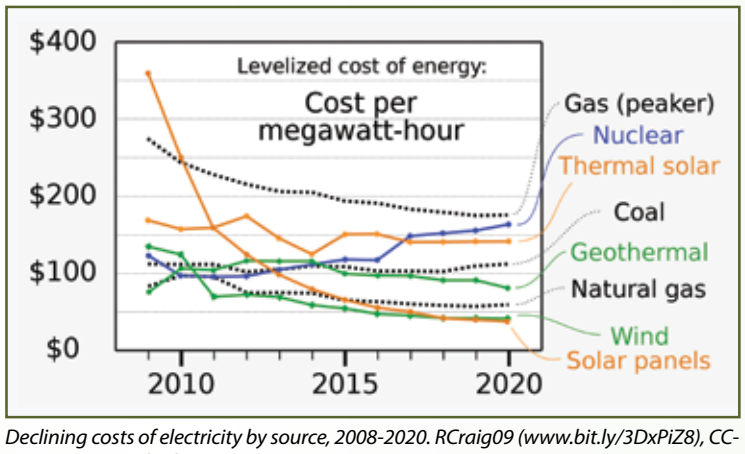
The cost of the nuclear plant does not include the backup systems it requires, but the price calculated for S+S does.

The load-following and peaker plants used to work with nuclear power, are slow to react to demand changes. By comparison, battery backup can respond nearly instantly, making it far more valuable.

Nuclear waste is an unsolved problem that the U.S. government guarantees, at taxpayer expense. The same is true for insurance, which is covered by the Price-Anderson act. S+S systems do not have comparable costs.

The author does not take into account Wright's Law, a recognized law of economics referred to as "the learning curve." It suggests that construction of a battery system of the size envisioned would be sufficient to drive the cost of storage down quickly enough to reduce the cost of the S+S system itself.

Electricity from new nuclear facilities is very expensive. It becomes far cheaper once the system is paid down. Please refer back to the bid from VY, of 6.5¢/kWh. By comparison the cost of electricity from S+S is very low. A report from February 2020, which appeared at *S&P Global*, "Falling U.S. solar-plus-storage prices start to level as batteries supersize," says that power purchase agreements have dropped into the range of 3¢/kWh to 4¢/kWh (www.bit.ly/Falling-SS-price). But the costs of solar, wind, and battery systems keep falling. According to the U.S. DOE's National Renewable Energy Laboratory, in an article published at *CleanTechnica*, the costs of S+S systems declined by over 12% from the first quarter of 2020 to the same quarter in 2021 alone (www.bit.ly/SS-dropping-costs).




*Declining costs of electricity by source, 2008-2020. RCraig09 (www.bit.ly/3DxPiZ8), CC-BY-SA 4.0 (www.bit.ly/38OKcvg)*

### Nuclear as an answer to climate change

There are some who feel that the nuclear industry may have a way to become relevant in the new "small modular reactors." An article on this appeared in the October 2021, issue of *Green Energy Times*, "When It Comes to Nuclear Power, 'Advanced' Isn't Always Better" (www.bit.ly/Advanced-nuclear). It explained that rhetoric around these reactors seemed to be unrealistic and achievable timetables were not able to help when we need most to address climate change, which is right now.

I would suggest that nuclear industry estimates about costs, timelines, and safety have historically been far off the mark, a problem that those promoting newer types of reactors have not addressed at all. In fact, it is almost as though the industry has three types of numbers.

There is one type that is simply correct, but it only relates to results of simple calculations.

A second type of number is one that relates to such things as the cost of a reactor or the time needed to build it. These seem very often to be off by a factor of 2. If a reactor is expected to take five years to build and cost $6 billion, it is probably best to bet that it will take ten years and cost $12 billion.

The third type is safety analysis calculations, that can actually be checked, have historically been off by an order of magnitude. Given the types of reactors that have operated commercially, the safety analysis made on them, and the time they have been running, industry estimates predict that we probably should have had only one commercially operating reactor experience a partial or full melt down worldwide since commercial nuclear plants first started delivering energy. Instead, we have had eleven – that we know of.

All told, we might say that putting money into nuclear power goes beyond being a monumental waste. It detracts from the overarching issue of dealing with climate change by making that money unavailable for dealing with the problem using less expensive, more reliable energy that can be built far more quickly. ♻

# USDA Invests $15 Million in Climate-Smart, Resilient Infrastructure for Rural Communities in New Hampshire and Vermont

**$14.4 Million Funding for GoLight LLC Among Projects to Make Rural Communities More Energy-Independent**

On December 06, 2021, the United States Department of Agriculture (USDA) Under Secretary for Rural Development Xochitl Torres Small announced the Department is investing $15 million to reduce the impacts of climate change on rural communities in New Hampshire and Vermont. With the enactment of the Bipartisan Infrastructure Law and as part of the broader Build Back Better agenda, the Biden-Harris Administration has made investing in rural communities, creating good-paying jobs and combatting the climate crisis top priorities.

"All of America depends on the success of rural America," said Torres Small. "President Biden is committed to helping people save money and find good-paying jobs while tackling the climate crisis and expanding access to renewable energy for rural communities in New Hampshire, Vermont and across the country. Thanks to the recent enactment of the Bipartisan Infrastructure Law, USDA will be able to make the essential investments in climate-smart solutions that support rural communities on the frontlines of increasing natural disasters. These are investments we all need now, more than ever."

## Background:

Torres Small highlighted 20 investments that USDA is making in two programs specifically designed to help people and businesses in rural areas. These programs include the Electric Infrastructure Loan Program and the Rural Energy for America Program.

For example:

- **GoLight LLC** will use a $14.4 million USDA Electric Infrastructure loan to construct seven solar arrays within Goffstown (2), Franklin (2), East Conway (1) and Pittsfield (2), New Hampshire. The projects will have a total rated capacity of 9.188 MWDC and they are expected to provide a net output of 6.75 MWAC. They will deliver power to Eversource Energy, a distribution utility that reduces electricity costs for its customers as older nuclear and fossil fuel plants are retired.
- **Orchard Hill Breadworks in Alstead, NH** will use a $31,245 grant from USDA's Rural Energy for America Program (REAP) to build a 32.5kW solar array where Owner Noah Elber's grandparents had lived since 1972. Before he repurposed the 19th-century barn on their property and turned it into one of Food & Wine's '100 Best Bakeries in America,' the structure had been a playland for him, his siblings and cousins. Read the Orchard Hill Breadworks USDA success story.

*Members of the Breadworks team take a quick break from work in front of the bakery. (Courtesy photo: Orchard hill Breadworks)*

- **In Bethlehem, NH, the Profile School District** will buy electricity at a discount from BP Profile, LLC, which will construct a 334-kilowatt solar array next to the school with help from an $80,000 REAP grant. The estimated 405,920 kilowatt hours generated per year is enough to offset nearly 100 percent of the school's current electricity use and save it about $500,000 over 30 years.
- **Eden Sand & Gravel in Eden, Vt.**, will install a 778.4 kW ground-mounted solar array with help from a $250,000 REAP grant. The 897,500 kWh produced will generate enough to power 82 homes and provide over $150,000 in annual revenue to the company.

These investments will help build and improve rural electric infrastructure and connect residents to affordable and dependable power. They will help agricultural producers and rural small businesses purchase and install renewable energy systems and make energy efficiency improvements. They will also help transportation fueling and biodiesel distribution facilities offer higher ethanol and biodiesel blends to customers by sharing the costs to install fuel pumps, equipment and infrastructure.

*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.*

*USDA touches the lives of all Americans each day in so many positive ways, transforming America's food system with a greater focus on more resilient local and regional food production, ensuring access to healthy and nutritious food in all communities, building new markets and streams of income for farmers and producers using climate, smart food and forestry practices, making historic investments in infrastructure and clean energy capabilities in rural America, and committing to equity across the Department by removing systemic barriers and building a workforce more representative of America. To learn more, visit www.usda.gov.* ♻



## CRITICAL MINERALS - LITHIUM – Cont'd from p.14

has an eagerness to bond and flow, and electricity loves to flow! Once a lithium battery is charged it can efficiently release current and the party is on.

Lithium is a truly amazing conductor of electricity, and it packs an electron punch like no other.


AdobeStock_299986719

Lithium is also used in aluminum to make extra strong alloys, glass to help prevent it from breaking at high heats, and is even used on the International Space Station to help soak up the carbon dioxide breathed out by astronauts. It's also readily available in the form of grease which makes for a lasting lubricant. Interesting stuff, for sure, and there's even some in the potato-tomato frittata you had for lunch today.

What does the future of lithium look like? Can it be recycled and re-used? What happens when we run out? Do we have a plan for lithium alternatives? And what does the mining, extraction, brining, and processing of lithium do to the environment and the people it impacts? We'll take a look at that in the next article.

*Dan Antonioli is a green developer, licensed general building contractor, and permaculture designer based in Ithaca, NY. His company, Going Green, is available to assist in a wide variety of green building projects. Visit www.going-green.co.* ♻

# A Realistic Path to a Bright Future

*Dr. James Hansen.*

*3 December 2021*

Why is nobody telling young people the truth? "We preserved the chance at COP26 to keep global warming below 1.5°C." What bullshit! "Solar panels are now cheaper than fossil fuels, so all we are missing is political will." What horse manure! "If we would just agree to consume less, the climate problem could be solved." More nonsense!

I address this to young people. I am sorry to say that, although the path to a bright future exists and is straightforward, it will not happen without your understanding and involvement in the political process. Ever since 2008 I have been amazed by your acumen and your ability to affect national elections and appreciate global issues. With appropriate focus, you can alter the course of our world in a good way. I hope that you find something in my experiences that helps you in your pursuit of a bright future.

Do not feel sorry for yourself or get discouraged. Yours is not the first generation to be dealt a bad hand. Some were born into great depressions. Some were sent to fight in world wars or senseless conflagrations in faraway places such as Viet Nam or Iraq. Your battle will cover more years. Nature has a long-time scale in its response to human-caused forces, and it takes time to alter human-made energy systems. But your cause is noble – your challenge is nothing short of guiding humanity and other life on our planet to a bright future.

The long-time scales should not dishearten you. The slow response of nature provides the time that is needed to alter the infrastructure of our energy systems and improve land use practices. However, your task is now urgent. The next 10 years – the fourth decade since the adoption of the Framework Convention on Climate Change in 1992 – must be the decade in which young people take charge of their own destiny.

On the scientific front, several colleagues and I assert that IPCC (Intergovernmental Panel on Climate Change) has underestimated the sensitivity of climate to growing freshwater injection from melting ice. One potential consequence – if we continue with business-as-usual emissions – is shutdown of the overturning North Atlantic and Southern Ocean overturning ocean circulations by midcentury, each of which will contribute to acceleration of mass loss from the Antarctic ice sheet, with the likelihood of sea level rise of several meters within the lifetime of children born today.

Existential climate threat arises from the combination of sea level rise, the increasing difficulty of life in the tropics and the subtropics in the summer as temperatures rise, and the increase of climate extremes as higher temperatures drive droughts, heat waves and fires, on one hand, but also heavier rains, greater floods and stronger storms on the other hand. These effects will increase emigration pressures from low latitudes and coastal cities, thus potentially creating a planet that is practically ungovernable.

*Teacher and group of toddlers drawing at kindergarten. (Adobe Stock/297900139/Krakenimages.com)*

Climate science reveals that we have overshot sensible targets not only for atmospheric carbon dioxide, but also for global temperature. We will need to return to a global climate no warmer than the middle of the 20th century, and likely somewhat cooler, for the sake of maintaining global shorelines. That task is made more difficult by our Faustian bargain with particulate air pollution, which has tended to diminish global warming by reflecting sunlight to space. Our Faustian payment is coming due as health-damaging particulate pollution is being reduced, Earth's energy imbalance is increasing, and the rate of global warming is accelerating.

The good news is that the aerosol and climate research reveal a pathway by which the present extreme human-made interference with Earth's energy balance can be diminished as fossil fuel emissions decline and greenhouse gas levels diminish. Don't worry – it does not require Frankenstein geoengineering of our home planet. Instead, we should reduce our present human interference with nature as promptly as practicable. An early requirement is that global greenhouse gas emissions begin to decline during this 4th decade of the Framework Convention. That does not imply that we must reduce global energy use – on the contrary, more energy will be needed to reduce poverty and raise global living standards – rather it implies that we need a realistic clean-energy plan and that we carry out the R&D to support it.

China and the United States, as the largest current and historical sources of emissions, should cooperate to achieve the most rapid transition to clean energies. De facto cooperation of the West and China helped drive down the cost of renewable energies, but more extensive cooperation will be needed to apply the brakes to accelerating climate change. As the largest economies in the world, the two nations have the ability to alter the global energy pathway via agreement on simple, honest carbon pricing, but adequate pricing becomes practicable only in concert with advances in carbon-free energy technologies including modern nuclear power. To achieve the cooperation that will speed these advances, scientists in the West and East can help lay the groundwork by continuing and expanding their mutual research to promote common understanding.

Young people in the United States have the most urgent and crucial task: to fix the broken two-party political system. You have the power and the means to achieve the political transformation that is required to break the grip that special interests have on Washington, our energy systems, and your future, but the transformation requires that you understand the underlying problem and organize accordingly. The urgency has more to do with the boiling frustrations of the public as they witness the endemic graft and incompetence of our elitist government. Young people must learn not to follow the siren of old orators from the broken system. You must take charge of your future. You have the incentives and the abilities to achieve the changes that are needed for the sake of both your nation and the world.

As for climate science, we have our own challenges. The forces that humanity is exerting on the climate system are unprecedented. The great inertias of the massive ocean and ice sheets are the cause of the greatest threat – because future change builds up without the warnings that public response requires – but these inertias also provide us opportunity to achieve a soft landing for humanity and nature, provided that we have adequate understanding of the system. As with your politics, our science must advance this decade so as to be in position to provide the guidance required to achieve that soft landing. Global climate models are a useful tool for that purpose, but they must be matched by comparable focus on paleoclimate – especially the Eemian period, which appears to have been as warm as today – and on ongoing physical processes, especially in the ocean and the periphery of Antarctic ice.

I am sorry that we elders are leaving you – young people – with such a burden, but I know that you will accept it as a challenge. You have a magnificent opportunity to change the course of history this decade, to move the world onto a realistic path to a bright future for your own sake and for that of your children, grandchildren and future generations.

*Read and learn much more at https://bit.ly/3dk25D6-Hansen-Bright-Future.*

*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.* ♻

# How to Prepare for Carbon Pricing

*John Gage*

If you are taking steps to become more energy-efficient and transitioning to clean energy options as you replace things over time, you are on the path to thrive in an economy in which the true costs of using fossil fuels (coal, oil, and natural gas) are reflected in their prices. But if you are considering oil or gas options for your next furnace or water heater, or if you plan to kick the tires of gasoline-powered vehicles when you look for your next car, this article may save you thousands of dollars over the next decade – please read on!

**Carbon pricing is unavoidable**

A price on carbon emissions from fossil fuels is essential to address climate change according to the IPCC, World Bank, WTO, World Economic Forum, OECD, and IMF, and carbon pricing is spreading rapidly. Over 45 countries are now pricing carbon – double the number from just five years ago – including every developed country except the U.S. and Australia, and prices are rising. Recently, the EU, UK, and Canada began preparing to charge free-riders for their pollution in trade. This will be a strong incentive for other countries to price carbon.

Whether the U.S. chooses to price carbon soon to meet Biden's emission reduction goals, or is forced to do it later this decade through trade, decisions made now will be cast in a new light when there is a price on carbon. Some things will become increasingly more expensive to use, and some investments will sour. Other choices will prove to be brilliant.

**Future-proofing with shadow carbon pricing**

Hundreds of U.S. companies are preparing by including a "shadow" carbon price in decision-making processes. Shadow carbon pricing is a way of factoring future higher fossil fuel prices into choices being made today. Does it make sense to update a fleet with gasoline- or electric-powered vehicles? Anticipating a high price on carbon by the end of this decade leads to decisions such as Hertz's plan to purchase 100,000 electric cars from Tesla. Some states (e.g. Colorado) and municipalities are using shadow carbon pricing in their energy infrastructure planning to avoid future stranded costs. Families can do this too.

Vehicle and heating choices matter because they lock the consumer into an energy source for years or decades. Solar panels make financial sense today, but when fossil fuels become steadily more expensive, clean energy will offer even greater relative savings. Energy audits and following through with recommended updates will likewise yield increased savings for homeowners, municipalities, and businesses when carbon pricing makes fossil fuels more expensive.

**What price to prepare for**

A $10 per ton of $CO_2$ tax adds about one cent per kWh on electricity from fossil fuels and 10 cents per gallon of gasoline.

The EU carbon price has more than doubled in the last year and is now over $80 per ton of $CO_2$ emitted. Canada's price will rise to $135 per ton of $CO_2$ by 2030, which is the minimum target price required to

*Cont'd on p.22*

# Off-shoring Our Carbon Emissions Responsibility

*John Bos*

Many world leaders and activists expressed disappointment with the climate deal that emerged from two weeks of heated climate change negotiations in Glasgow, Scotland at the 26th COP. They warned that countries will have to strengthen their commitments if they want to avert disastrous consequences and help at-risk nations cope with the damage that is already the result of the climate crisis.

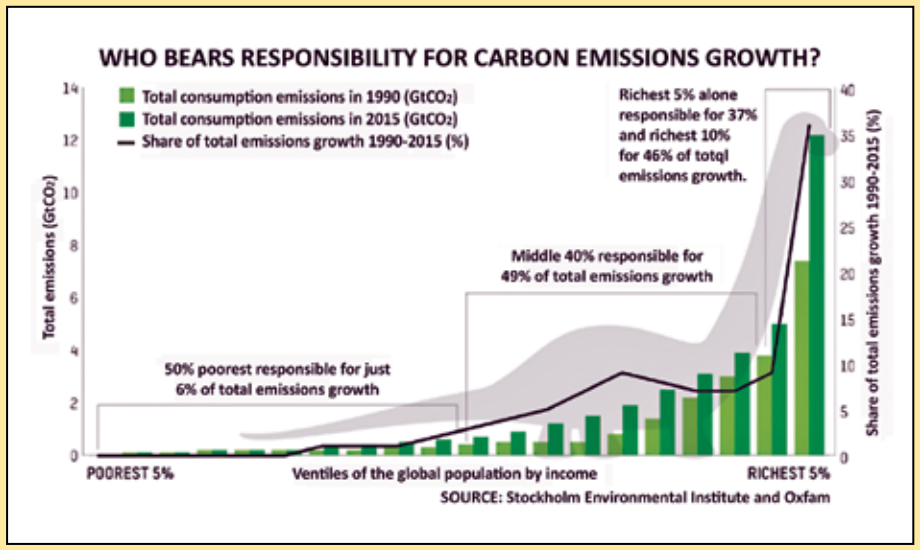
The new Climate Pact urges countries to "accelerate efforts towards phasing down" rather than "phasing out" coal-generated power that isn't mitigated by carbon capture and storage. This subtle change to the wording surfaced at the end of COP26, the latest UN climate change conference, at the insistence of India and China. So, are these two countries to blame for the summit's disappointing outcome, as many are suggesting?

Many defenders of U.S. climate policy blame China and India for being major contributors to the carbon emissions befouling our world. Per person, emissions in both China and India are still substantially lower than almost all developed countries. India's per-person emissions are less than one-quarter of the global average, and roughly one-tenth of those in the U.S. Close to a quarter of all carbon emissions come from manufacturing products which are exported and consumed in other countries. Textiles and clothes exported from India and south Asia account for only 4% of global emissions.

Labelling India and China as the chief villains of COP26 is a convenient narrative. The financial aid which rich countries promised, yet failed to deliver as part of the 2015 Paris Agreement, was supposed to help developing countries dump coal for cleaner sources of energy. "It is inexcusable that developed countries failed to meet their commitment to deliver $100 billion annually starting in 2020 even as they provide hundreds of billions of dollars in subsidies for fossil fuels each year," said Ani Dasgupta, President of the World Resources Institute.

And while the world berated India and China for weakening the Glasgow Climate Pact's coal resolution, few questioned the fossil fuel projects being floated in developed nations, like the UK's Cambo oilfield and the Line 3 oil pipeline between Canada and the U.S. For the record, the United States is the largest historical emitter of carbon emissions, while China has been the largest emitter in recent years.

Coming out of COP26, U.S. Special Presidential Envoy for Climate John Kerry said "The United States and China have no shortage of differences, but on climate - on climate, cooperation is the only way to get this job done. This is not a discretionary thing, frankly. This is science. It's math and physics that dictate the road that we have to travel." We'll see.




The richest 10% accounted for over half (52%) of the emissions added to the atmosphere between 1990 and 2015. The richest one percent were responsible for 15% of emissions during this time – more than all the citizens of the EU and more than twice that of the poorest half of humanity (7%).

Most wealthy countries have a much larger carbon footprint than can be seen by just by totaling up the amounts of energy they use within their boundaries, while ignoring the footprint generated when goods are manufactured elsewhere. This is referred to as a consumption-based accounting method. It's a method that is inaccurate and unfair to the poor countries, many of which produce the things we want for a "more rewarding" life.

Asad Rehman, executive director of War on Want, addressing the U.N. climate assembly, said that this consumption per capita is a flawed metric, as most polluting industries have been moved to developing nations and not reflective of the rich nations' responsibility for carbon emissions.

Supporting Rehman's claim is the fact that 42% of the manufactured goods that we "enjoy" in America come from China alone. That's everything from electronic goods to parts for our cars as well as our clothes. To save on manufacturing costs, we have offshored virtually everything we want to other countries. This means we are also "offshoring" our CO2 emission responsibilities. So, when we're looking at America's total amount of emissions, we have to include the carbon footprint our lifestyles create.

Most of the people framing the climate debate in Glasgow are people who live in high-emitting countries – the climate scientists, business leaders, journalists, many lawyers and lobbyists, and fossil fuel industry representatives. They have the money and wherewithal to frame the debate in ways that continue business as usual. In ways that drown out the voices from small Pacific Island states and other third world countries. Equity has never been a core principle in the climate debate. The representatives from high-emitting countries are not interested in equity. Or they don't want to "afford" it.

Negotiators for the Global South cited the historical responsibility of the Global North to pay for loss and damage for climate change, given the North's historical emissions. Countries in the Global North, especially the U.S. and the EU, fear that loss and damage could open the door for liability and so are vehemently opposed.

Asad Rehman, speaking on behalf of the climate justice constituency, said, "It's immoral for the rich to talk about their future children and grandchildren when the children of the Global South are dying right now."

The COP26 agreements intended to save the world from the worst of climate change impacts are built upon data. But the data the world is relying on is inaccurate. A new Washington Post investigation has found that across the world, many countries underreport their greenhouse gas emissions to the United Nations. An examination of 196 country reports reveals a giant gap between what nations declare their emissions to be versus the greenhouse gases they are actually sending into the atmosphere. The gap ranges from at least 8.5 billion to as high as 13.3 billion tons a year of underreported emissions – more than enough to move the needle on how much the Earth will warm.

Once again, at a worldwide climate summit, the richest nations have ignored every moral and political call to stop the extraction industries from poisoning our environment. Their broken promises are now littered across 26 COPs. Empty press releases drafted by polluting companies no longer fool anyone. Of the almost 40,000 delegates at the U.N. summit in Glasgow, there were 497 delegates from Brazil, 230 from the U.K. and 165 from the U.S. The largest "delegation" was the 503 people associated with the fossil fuel industry and economy.

Four young women – Sweden's Greta Thunberg, Uganda's Vanessa Nakate, Poland's Dominika Lasota, and the Philippine's Mitzi Tan - issued a worldwide emergency appeal via the internet to world leaders for "real" climate action at the COP26 on behalf of the 100,000 youth protesters in the streets of Glasgow.

It was inspiring to watch these activists – especially young people and those from the global south – as this Glasgow COP26 limped towards its mushy end. They were on top of every twist in the text, and they won significant concessions from the big polluting countries. The activists' anger echoed through the halls and was heard in whatever parts of the world were listening. To the extent that this COP worked at all, it's a tribute to their perseverance and creativity.

Greenpeace International director Jennifer Morgan, a long-time climate talks observer, said that the call in the draft to phase out coal and subsidies for fossil fuels would be a first in a U.N. climate deal, but the lack of a timeline would limit the pledge's effectiveness. "This isn't the plan to solve the climate emergency. This won't give the kids on the [Glasgow] streets the confidence that they'll need," Morgan said.

Next year's summit, COP27, is scheduled to convene in Sharm El-Sheikh, Egypt. Whether Egypt will permit this kind of street-based protests by young climate activists is doubtful. Egyptian authorities have consistently shown no hesitation in using a heavy hand to silence their own human rights protesters.

*Contributing writer John Bos's "Connecting the Dots" column appears every other Saturday in the* Greenfield Recorder. Green Energy Times *readers can request copies of his recent three-part series* "Eco-Anxiety" *at john01370@gmail.com. He is the editor of a new children's book* After the Race *available on Amazon.* ♻

## Center for Research on Vermont: Vermont Research News

### Energy transition has unequal benefits

A new study suggests that gaps in Vermont's renewable energy policies are leaving behind vulnerable people. Using nearly 600 surveys and interviews, the study shows that low-income, non-white and renting Vermonters are less likely to have access to renewable energy systems and the other related benefits. The study suggests that Vermonters in these categories don't see the same benefits from energy transitions as wealthier and whiter residents.

### New forest monitoring tool

*Photo by Sebastian Unrau (www.bit.ly/3lFO5rU) on Unsplash (www.bit.ly/3xXybhz)*

The Forest Ecosystem Monitoring Cooperative, based in Burlington, has launched a new online tool focused on forests across the northeastern U.S. The tool allows users to filter the programs based on a set of climate-change indicators across categories like aquatic systems, forest systems, trees and wildlife. The tool includes details about 350 programs in Vermont, New York and greater New England. Part of the goal is to give landowners, land managers and researchers standard protocols that they can use in their own monitoring programs.

### Plastics' emissions outstrip coal

A new report by the Bennington College based Beyond Plastics finds that plastic production will produce more carbon than coal by 2030. Fossil fuel companies are turning to plastic production as a new source of revenue the report finds, with current emissions from plastics production equivalent to 116 coal-fired power plants.

To read more news, please visit the UVM Center for Research on Vermont website at crvt@uvm.edu. ♻

# LIMITED PROGRESS MADE AT COP 26

*Cont'd from p.1*


that now contributes about a quarter of the current warming. It is a much more powerful GHG than CO2, but its atmospheric lifetime is much shorter, so it can be removed more rapidly if emissions are reduced. Reducing methane emissions is thus one of the few levers the world has to slow warming in the critical next decade or two and 105 countries joined the U.S.-led Global Methane Pledge, which aims to reduce methane emissions 30% by 2030. While in principle, we accelerate the transition to a net-zero carbon economy, China and Russia were absent.

Similarly 100 leaders representing over 85% of the world's forests, including the Amazon rainforest, Canada's northern boreal forest, and the Congo Basin rainforest pledged to end deforestation by 2030. The pledge is backed by almost $20 billion in public and private funding, which seems way too little. Talking about these "cathedrals of nature and lungs of the planet" is fine rhetoric, but similar promises made in 2015 have not stopped the ongoing destruction of forests by logging, mining and conversion to agriculture.

More than 40 countries pledged to move away from coal and committed to end investment in new coal-fired power plants. In Europe, Germany, the largest coal user, has a 2030 phase-out goal and Poland and Ukraine advanced their goals of phasing out coal use to 2030 and 2035. Notably, many major economies including the United States, China, India and Japan have set no dates for ending the use of coal.

The dark reality is that there were at least 500 fossil fuel lobbyists with official access to the COP26 climate talks in Glasgow. That's more than the largest country's delegation! By lying to deceive the public and bribing politicians, they have delayed action on phasing out fossil fuels for decades. They intend to remain in control, since they can make trillions of dollars in profits from destroying the stable climate of the planet. They made sure the COP26 meeting did not discuss how much fossil fuel we need to leave in the ground to keep global climate warming below 2oC. It is considered 'progress' that the COP26 report has for the first time an evasive reference to accelerate phasing out "inefficient" subsidies for fossil fuels!

So instead of real progress on eliminating the burning of the fossil fuels, the final COP26 text calls on countries to submit more ambitious carbon-cutting plans by the end of 2022. Some progress was made on the transparent accounting of emissions.

There was a lot of talk about climate justice and distributing the long-promised $100 billion a year to poorer countries that now experience some of the worst effects of climate change; despite the fact that they are not responsible for most emissions now or in the past. Some promises were made to fund the phase-out of coal fired power plants in developing countries and replace them with renewable power. But the rich nations (who got rich burning fossil fuels) resist any commitments for compensation to poorer countries, as they do not want to accept liability. The injustice is very clear, but most poorer countries face the climate crisis without much help, since most rich countries lack the resources to protect even their own infrastructure against climate extremes and rising sea level.

Huge numbers of citizens, protesters, as well as religious groups and scientists, who have no seat at the table, came to Glasgow to make their cases in demonstrations. Swedish activist Greta Thunberg, who has listened to so many meetings in the past few years, urged the leaders gathered for COP26 to act, and stop their "blah blah blah." There were 100,000 people at the protest march on November 6, the largest demonstration Glasgow has ever seen. The police described the demonstrators as "good-natured and in high spirits," but their impact on the meeting is unclear. They know they are the sacrificial pawns of capitalism. Their role is critical however, as it will be up to protesters and indigenous people around the world to hold governments to their promises, when they try to backslide.

*Major floods are a common occurence already as a consequence of climate change--just one of the many disasters we face today. (AdobeStock_465262597)*

Unfortunately fossil fuels are the basis of business-as-usual consumerism that is the source of wealth for the powerful, who are content to destroy the climate and much of life on Earth for trillions in profits. The "fossil fuel empire" has the power and money to bribe politicians and limit action in the U.S. Congress. Most recently it has shifted to greenwashing adverts to mislead the public. One from Exxon-Mobil cheerfully says, "Every technology we're working on helps lower our carbon footprint. Because when it comes to addressing climate change, our actions make a difference." Since their actions have been driving the climate crisis for 40 years, this is just criminal lying.

The history is very sobering, but worth reviewing. At the first Earth Summit in 1992, President George H. W. Bush signed the United Nations Framework Convention on Climate Change, which committed the world to preventing "dangerous anthropogenic interference with the climate system." However, the U.S. insisted that the convention included no timetable or specific targets for action. In 1997, President Bill Clinton signed the Kyoto Protocol which said the U.S. would cut its annual GHG emissions by seven per cent, but the Senate wouldn't ratify it, and under George W. Bush, the country withdrew from the agreement, and U.S. emissions rose. By 2009, the planet was headed for dangerous warming and President Barack Obama pledged that the U.S. was at last ready to act. Nevertheless, COP15 ended with no agreement, and at COP21 in Paris, nations were invited to just submit their own voluntary emissions targets. This meant the U.S. Senate did not have to approve a new binding agreement. These voluntary targets were not met. In reality, Obama was proud that U.S. oil production rose by 77% during his administration from advances in fracking technology. Imports fell by less so U.S. consumption increased. Then Donald Trump announced that the U.S. wouldn't honor its commitments and scrapped many environmental laws.

Now at COP26, the world cheered when the two biggest polluters, China and the U.S., agreed to cooperate on key issues, but in reality, their global power struggle may conflict with saving the Earth!

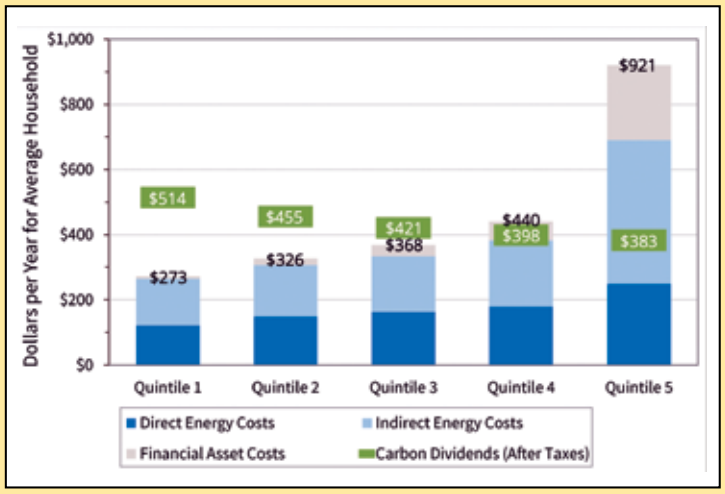
It is obvious that the climate crisis is out of control. The Earth will likely cross the upper 2oC temperature threshold in the Paris agreement, heading for 3oC. We must choose between the Earth and the fossil empire and business-as-usual capitalism. The choice is obvious: we must choose the Earth. Indigenous people have known this for thousands of years, but 'modern western society' has done everything it could to destroy the indigenous mindset. The deep shift in consciousness to back the Earth, who is in charge, is still heresy; and almost impossible for our society, obsessed with human power and greed. So, in parallel we must support the protest movements and encourage our youth to simply shut down the financial and business interests that intend to destroy both them and life on Earth for profit. In time, the Earth will win by destroying our fossil infrastructure, but simply replacing it quickly would be much wiser.

*Dr. Alan Betts of Atmospheric Research in Pittsford, VT is a climate scientist. Learn more at alanbetts.com.* ♻

## Carbon Pricing

*Cont'd from p.20*

hold global warming at or below 1.5˚C from pre-industrial levels, according to the IPCC. Canada achieved that price by charging fossil fuel producers a steadily rising fee based on the carbon in the products they sell and giving the money collected to all Canadian households. This is a popular approach because most families come out ahead financially, and those working to reduce their carbon footprints come out even further ahead. Despite initial resistance, the policy has gained broad support. Prime Minister Justin Trudeau, a strong proponent of the policy, has since been re-elected twice.




*Comparison of household costs incurred from a $15 carbon fee with carbon dividends. Each quintile represents 20% of the population, ranked by consumption. Carbon dividends are net after personal income tax. (Citizens' Climate Lobby, Household Impact Study)*

One group working to create the political will for this approach is Citizens' Climate Lobby (CCL), a nonpartisan, grassroots organization that has been laser-focused on this goal for over a decade. A bill in Congress based on CCL's Carbon Fee and Dividend policy called the Energy Innovation and Carbon Dividend Act (HR 2307) has over 85 co-sponsors. It puts a carbon fee on fossil fuel production and imports that increases by $10 per ton of CO2 annually for three decades, returns all the money collected to families on an equal per-capita basis each month, and uses border carbon adjustments to protect U.S. business competitiveness in trade. A study commissioned by CCL found that low-income households will receive an average of $241 in extra spending money (after accounting for higher costs) in the first year of implementation (see chart), and Regional Economic Modeling Inc. estimated an annual average after-tax gain of $1000 per capita in the tenth year for the New England region (carboncashback.org/benefits).

**Help accelerate carbon pricing**

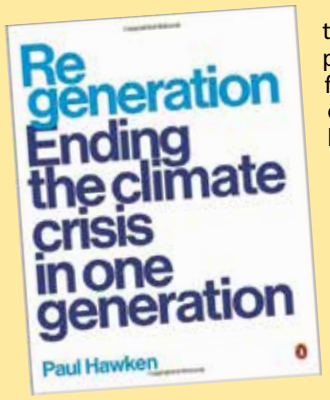
The sooner the U.S. starts pricing carbon, the more gradually the price can rise, making it easier for U.S. businesses and families to adapt. According to Senator Whitehouse [RI], the Senate has 49 of the 50 Democrat votes needed to include cash-back carbon pricing in the reconciliation package this year, and negotiations are ongoing. The House and White House also support the approach.

Steady, positive pressure from businesses and citizens can give Congress the political courage they need to get this done. Businesses can endorse the Energy Innovation Act and lobby for Carbon Fee and Dividend legislation. Citizens can find quick and easy actions to take at cclusa.org/action.

*John Gage is the volunteer New Hampshire State Coordinator for Citizens' Climate Lobby.* ♻

# "The Agent Who Can Head Off the Climate Crisis Is Reading This Sentence"

*Jessie Haas*




Paul Hawken's new book, *REGENERATION: Ending the Climate Crisis in One Generation*, is deeply informed by his Buddhist practice, by the newest findings of climate scientists, and by muscular hope.

Hawken writes, "Regeneration means putting life at the center of every action and decision. It applies to all of creation—grasslands, farms, people, forests, fish, wetlands, coastlands, and oceans—and it applies equally to families, communities, cities, schools, religions, cultures, commerce, and government. Nature and humanity are composed of exquisitely complex networks of relationships, without which forests, lands, oceans, peoples, countries, and cultures perish."

The book delves deeply into these exquisite networks, showing how each contributes to the whole. Schools of fish rise to the surface, feed, poop, sink, and die, cycling cold waters into warm surface waters, keeping ocean pH from becoming too acidic, and sequestering carbon. Salt marshes also sequester carbon, as do mangroves and sea grasses, all the while feeding and sheltering fish and taking up excess nutrients. Forests send bacteria and pollen into the air to seed rain, and sugars into the soil to sink carbon. Grazing herds and grasslands interact to cool the planet and impact the water cycle.

These life systems are in peril, but Hawken sees each peril as an opportunity. Seaweed farms, marine protected areas, wildlife corridors, pollinator gardens; each improves planetary health. So does improving the lives of poor people. Jane Goodall, in her introduction, notes that the forest surrounding the Gombe reserve had disappeared by the mid-80s, cut for farming and charcoal. Goodall's organization, guided by the local people, helped them improve soil fertility, water management, schools, and clinics. People prospered while protecting nature. Their lives are better, and the forest is back. According to an article in *Science Direct*, the benefits include improved water and forest resources for both people and wildlife. The success here has inspired other conservation projects in Tanzania and across Africa.

Industry and businesses, including banking, clothing, big food, healthcare, and the poverty industry (including for-profit prisons and refugee camps, and human service corporations), is a big problem, one Hawken does not shy away from. "Cynicism is understandable, given the process of greenwashing. But underneath these [regenerative] commitments are people, just like the person reading this page. People who have children, families, and communities, people who see the looming crisis writ large...[t]here is no point in tiptoeing around the causes of global warming. We are either in a crisis or we are not...We know what needs to be done. The question is how do we come together, get it done, and make it right?"

One way is by using offsets, or as Hawken prefers, "onsets." An offset is a promissory note, to balance your current greenhouse gas emissions by an equal amount in the future. But offsets do "almost nothing to chip away at the legacy carbon that has been accumulating in the atmosphere for decades." Instead, Hawken urges, convert offsets to onsets. By buying twice or three times as much as is needed to simply make your activities carbon-neutral, you help pay down our society's accumulated carbon debt. " . . . [I]nstead of simply neutralizing the emissions from the twenty thousand miles you put on your car for a hundred dollars, double the amount and pay forward . . .to a verified project that draws down extra greenhouse gas emissions while restoring degraded land and improving the well-being of humans and nature...[i]f two people paid their debt forward—or four people, or four hundred—measurable reductions in atmospheric carbon dioxide will occur." He advocates choosing fast-acting onsets, such as protecting forests or giving people clean cookstoves, to immediately eliminate emissions, protect life systems, and sequester carbon. Speed matters; do it now, do it fast, and do as much as you can.

*Houses in a Houston suburb flooded from a hurricane. (AdobeStock_218787659/banphot)*

The last section, "Action + Connection," offers a checklist of twelve questions. Does the action create more life or reduce it? Does it heal the future or steal from the future? "Most of what we do does not tick all the boxes. However, like a compass, it shows us the directions...by employing the guidelines you pivot."

Next, create a punch list. "The true top solutions are what you can, want, and will do." Hawken offers two sample punch lists from a homeowner and a small food company, each committing to seven regenerative changes. You can go on the Regeneration website to read other punch lists and prepare and share your own.

Individual actions are important, but Hawken notes that as social creatures, humans work best in groups. We're not great at responding to abstract threats, but 'humans are notably brilliant at joining together to solve problems. Give us immediate threats like an impending cyclone, flood, or hurricane, and we're all over it...[t]o reverse global warming, we need to address current human needs, not an imagined dystopian future."

And enjoy ourselves doing it. Hawken finds beauty even in our current peril. "The earth's biological decline is how it adapts to what we are doing. Nature never makes a mistake. We do. The Earth will come back to life no matter what. Nations, peoples, and cultures may not. The earth is homeschooling us," he says. This is a watershed moment. But we created this moment, and we can respond to it, not in a joyless, puritanical way, but regeneratively, bringing ourselves back to life as we transform the world. "The agent who can head off the climate crisis is reading this sentence."

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

*Jessie Haas has lived in a tiny, off-grid cabin in Vermont for over thirty-five years. She's the author of forty-one books, including* The Hungry Place. ♻

## Difference Between 1.5°C and 2°C of Global Warming? – Cont'd from p.1

some cases they have disappeared altogether. We have photographs recording glaciers melting all over the world for over a century, and the speed of the melting is clearly accelerating. This is happening because a lot of heat from the atmosphere is going into the glaciers.

Now, we are worrying about melting ice in the polar regions, especially on Antarctica and Greenland. The amount of ice melting is so great that the sea levels are increasing. The process removes a lot of heat from the atmosphere, but it is speeding up anyway. Without global warming, the whole process was balanced, but now, it is not.

*As the ice melts, it makes rivers, that rush to the ocean. (NASA image. www.go.nasa.gov/3pqnmkd)*

*Tasermiut Fjord. Greenland is turning green. (Visit Greenland, Unsplash. www.bit.ly/3cvjLLF)*

The rising sea levels are threatening to put some places under water. The Marshall Islands are likely to be lost, and all their people will have to move to new homes in other countries. Miami is also likely to be lost, along with a large number of other places along the seaboards of the United States.

All of this is happening because carbon dioxide ($CO_2$) can trap sunlight. Please note here that the $CO_2$ does not have to react with anything to do this. As heat is trapped, the $CO_2$ stays in the atmosphere, trapping more.

So the heat will keep going up until $CO_2$ is removed from the atmosphere, a process that has been kept in balance by trees, grass, and other plants. But plants cannot remove the amount of $CO_2$ that we put into the air.

Things are out of balance. The amount of $CO_2$ is growing, and it is causing heat to be trapped faster and faster. To counter this, we must get things back into balance again. And to do that, we have to do two things. First, stop increasing the amount of $CO_2$ in the air, and then, reduce it to the point that balance has been restored. The longer we continue increasing the $CO_2$ in the air, the harder the job of restoring balance will be.

If we can do the job of reducing emissions of $CO_2$ sufficiently, then we will be able to limit global warming to 1.5°C through 2050. Otherwise, global warming can go to 2.0°C or even higher. The difference between these two may seem small, but it represents an amount of energy that is far beyond the abilities of most of us to imagine.

As small as the difference between 1.5°C and 2.0°C is, to get to the higher temperature, an almost unimaginable amount of ice would have to melt along the way. An article at *Reuters* quoted Dr. Michael Mann saying that melt would be enough to cause major ice shelves in the Arctic and Antarctica to collapse (www.reut.rs/3nBg7pH). And with that, the changes around the world would be catastrophic. ♻

## A Surprisingly Hopeful Report About COP26

*Carl Pope*

Just as we are going to press, an article by Carl Pope arrived. It is titled, "The Surprisingly Hopeful Moral of the UN Climate Summit." And as the title indicates, the article itself is quite hopeful about the direction of climate change.

In the article, Pope said, "The strong prognosis is the climate is seriously injured but can recover, with some hard work. Multiple new analyses suggested, for the first time, that the original goal of limiting the planet to 2°C of warming could be achieved if every country kept its existing and new COP26 commitments. Rystad, a major oil industry analyst, suggested we were on a trajectory that could limit emissions to 1.6°C – close to the 1.5° Paris goal."

This is without doubt the most optimistic assessment we have seen on the issue of climate change. It is a story of hope that we believe everyone should see.

Unfortunately, it was too late to include the article in this issue. We don't want our readers to wait two months to see it, however, so we put it up online. You can read what Carl Pope has to say here: www.bit.ly/GETing-to-1point6.

*Happy Holidays!*

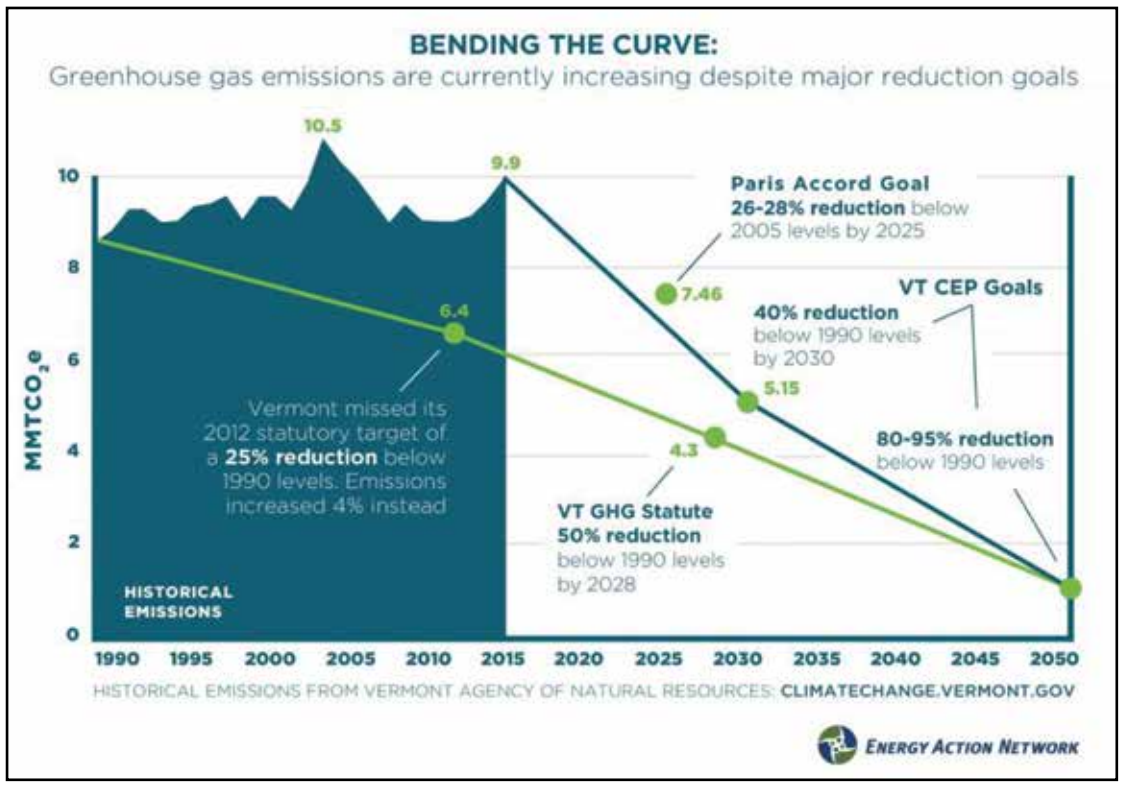
# INITIAL VERMONT CLIMATE ACTION PLAN IS ADOPTED

*Brian Shupe*

On December 1, 2021, the Vermont Climate Council adopted its initial Climate Action Plan on a strong 19-to-four vote.

The Council has been working incredibly hard to meet the statutory deadline of releasing its initial Plan on December 1st, which they accomplished. Next up, far more outreach is needed with public engagement and consideration of public input - particularly from historically marginalized populations.

In the meantime, key policies advanced in the initial Climate Action Plan include:




- A clean heat standard, analogous to a renewable energy standard for the heating sector, which will help Vermonters access clean and affordable heating options;
- A dramatically scaled-up investment in weatherization, which will help many more Vermonters - particularly lower income and historically marginalized Vermonters - access weatherization services to cut their heating bills and have healthier and more comfortable homes, while cutting their climate pollution;
- A suite of transportation investments to help people access clean and affordable transportation options, and a recommendation to adopt California's Advanced Clean Cars II and Advanced Clean Trucks rules to help drive innovation and market deployment of more clean, efficient vehicles;
- A recommendation to adopt an environmental justice policy;
- A recommendation for an updated renewable energy standard; and
- Adoption of a suite of smart growth policy priorities that will support more climate-resilient communities through well-sited housing and other development in compact community centers, paired with stronger protections for our forests, farmland, wetlands, rivers and other vital natural resources.

An important note related to transportation: as you might have seen, last week Massachusetts and Connecticut announced that they would not be implementing the Transportation and Climate Initiative Program (TCI-P) right now, which the Council had included as its highest-impact transportation recommendation in earlier drafts of the Plan. Leaving TCI-P out of the Plan creates a gap in pollution reduction that must be filled. The Council signaled its intent to adopt an updated Plan no later than June 2022 to identify additional actions we must take in the transportation sector.

The Council also left open the option for Vermont to participate in TCI-P or another cap-and-invest program for the transportation sector in the future, and urged quick legislative action to set the table for receiving potential revenue from any such program, while establishing criteria and a process for cost-effective, equitable transportation investments.

Brian Shupe, Executive Director of Vermont Natural Resources Council (VNRC) relayed, "I want to share my sincere gratitude for the countless hours and immense amount of work the Climate Councilors and Subcommittee Members have put into this process already. And thanks to all of YOU who took the time to weigh in throughout the process."

While many of the details must still be worked out, and much more community input must be gathered, the plan provides an important foundation for action. It makes clear that the administration and lawmakers can and must take strong action to meet our climate pollution reduction, equity, and resilience targets.

With unprecedented federal funding available, there are no more excuses, and no time to lose. We must get to work implementing solutions laid out in the Climate Action Plan that will help all Vermonters benefit from the clean energy economy.

*Brian Shupe is the Executive Director of the Vermont Natural Resources Council (VNRC). Learn more at vnrc.org.* ♻

# Vermont Must Better Protect Water and Soil from Climate Change-Induced Weather Patterns

Three Vermont environmental organizations requested in late November that the Vermont Agency of Agriculture, Food & Markets (AAFM) review its Required Agricultural Practices (RAPs) to better protect Vermont's water quality and soil health from climate change-induced weather patterns. (https://bit.ly/VT-Protect_Water)

The 2021 Vermont Climate Assessment notes that both summer and spring precipitation have increased in the Green Mountain State, negatively impacting farm and forestry operations. With more precipitation, manure applied to farmland is more likely to be washed into surface waters than absorbed into the ground, affecting water health and soil quality due to excess erosion.

Increasingly intense rainstorms associated with climate change may also release more phosphorus and other nutrient pollution. These factors, combined with warming temperatures, create favorable conditions for cyanobacteria blooms, which can make water unsafe for drinking and recreation.

Accordingly, advocates from the Vermont Natural Resources Council, Lake Champlain Committee, and Conservation Law Foundation argue that AAFM should examine its RAPs to determine if they are adequate to protect farms' soil resources and prevent erosion and harmful runoff of nutrient pollution into surface waters.

Recommendations include:

- Revisiting eligibility requirements for farms so that fewer farms, particularly those with adult livestock, are exempt from RAPs
- Ensuring that standards and restrictions for manure application are adequate
- Determining whether requirements regarding the storage of manure and other agricultural wastes need to be adjusted to take these weather events into account.
- Determining whether current requirements are adequate to protect farm structures from flood damage and protect private property downstream in case of destructive flood events

*"…climate change has negatively influenced many factors affecting water and soil health in this state," said Jon Groveman, Policy and Water Program Director at VNRC. (Courtesy photo: Bob LoCicero)*

"Since the RAPs were first written, climate change has negatively influenced many factors affecting water and soil health in this state," said Jon Groveman, Policy and Water Program Director at the Vermont Natural Resources Council (VNRC). "It's time we revisit and revise many of these requirements to adequately protect our natural resources."

"Polluted storm runoff from farms has the potential to destroy the health of Lake Champlain and other iconic waterways," said Elena Mihaly, Vice President and Director of Conservation Law Foundation Vermont (CLF). "It's clear that rain is washing untreated manure from farm fields into our waters. With the climate crisis bringing even heavier precipitation to Vermont, it's time state officials get this problem under control."

"The 2021 Vermont Climate Assessment and the 2021 Lake Champlain State of the Lake and Ecosystem Indicators Report highlight the impacts of climate change in our region and the trends are troubling," said Lori Fisher, Executive Director of the Lake Champlain Committee (LCC). "It is likely that increased frequency and intensity of storm events will release more nutrients into our waterways, harming aquatic habitat, diminishing recreational opportunities, and causing economic harm. It's important that AAFM review the RAPs to determine if updates are needed to protect water quality." Learn more at www.bit.ly/VT-Protect_Water. ♻

## Efficiency Vermont's Efficiency Excellence Network (EEN)

# Contractor Spotlight: Vermont Heating and Ventilating

### Interview with Steve Poole, Engineering and Sales for VHV

**VHV is a 70-plus-year-old mechanical contracting business headquartered in Winooski, Vermont and serving several states in the Northeast.**

*From Efficiency Vermont*

**Efficiency Vermont: Tell us a little bit about your background.**

**Steve Poole:** After graduating from Vermont Technical College in 1979, I took a job here and have called Vermont my home ever since. I have worked in the HVAC and plumbing industry throughout my career, and I specialize in seeking out and implementing creative energy-saving solutions. I've been at VHV for 20 years.

**Let's talk about ground-source heat pumps (GSHPs). This is a relatively new trade group for the Efficiency Excellence Network. Can you give us a quick explanation of the technology?**

**SP:** In simple terms, an air source heat pump unit works by adding heat [to a building] in the winter and taking it away in the summer. But the air can be challenging to extract heat from when it's zero degrees out. In a GSHP system, the heat is pulled from the ground in the winter and rejected into the ground in the summer. The advantage over an air-based system is it's more efficient to pull heat from the ground, because

from about five feet down, the ground is a pretty constant temperature. The technology is efficient 12 months a year.

If you have a system that's what I call an open well, you pull up the water, and inside the building is a heat pump. The fluid is what's transferring the heat. We drill that large well, get a large quantity of water, extract the heat, and dump the water into another well right near it.

But say on another site, you drill and you don't hit any water. You make a closed-loop system. You put a plastic pipe into the ground and fill it with water aboveground. The ground heats the water, and it just recirculates.

**Do you need a lot of space to put in a GSHP system?**

**SP**: No. Most of the ones I've been involved in use simple bore holes, which can be drilled anywhere around the building. I've seen them under a parking lot. It could be 500 feet deep, vertical bore hole with a closed-loop system. It's connected back to the building and you never see it.

But a GSHP system really has to be fitted to the building. Every site is different; it's not a cookie-cutter technology.

**What might discourage someone from using this technology?**

**SP:** The cost of tapping the ground is high. Those systems are costly to set up. What's made GSHPs more popular recently is that the U.S. Department of Energy and Efficiency Vermont created initiatives to use electricity more efficiently. The government offers tax credits to help offset the cost.

I think it's potentially a big market. But it takes an owner willing to look not just at the simple payback period but at the whole picture—what does it cost me to own, what does it cost me to maintain?

**What's the level of awareness of GSHP technology among your customers?**

**SP**: I would say they have heard of it; they've read about it.

There's no question that drilling is expensive, so those tax credits are key. The carbon footprint of GSHPs is also way lower than other heat sources, which is attractive to people. The other attractive part is combining a GSHP with solar PV on the roof. If you are generating your own electricity, and you have a GSHP, it is all electrically driven and very efficient. You are now offsetting the heating and cooling costs on your house with electric you generated on site. Not all homeowners with this setup generate 100% of their load, but they generate almost all of it. And that's possible for businesses as well.

*Interested in becoming a part of Efficiency Vermont's Efficiency Excellence Network? Making Vermont more energy efficient is a collaborative effort and would not be possible without a strong network of independent contractors. In 2014, Efficiency Vermont created the Efficiency Excellence Network in order to better support and encourage Vermont contractors to provide energy-efficient solutions in the field. There are currently over 400 members in the Efficiency Excellence Network, including VHV of Winooski, Vermont.*♻

# Contractors are Calling It a Game Changer for Geothermal



*G.E.T. Staff*

Energy Catalyst is an Albany-based manufacturer of geothermal heat pumps specializing in boiler-to-geothermal conversions. Founded in 2019, Energy Catalyst developed a heat pump that is lower cost and high efficiency for residential hot water heating systems. In the first of a two-part series, founder Matthew Desmarais sits down to talk us through their progress.

*Installation of an Energy Catalyst heat pump on a huge 6,000 sq ft house with old baseboards.*

*Heat pump with panels removed at Averill Park. (Photos: Matthew Desmarais)*

### How did you get into geothermal heating and cooling?

Energy Catalyst started as a specialty geothermal contractor in converting homes with baseboard or radiators, but I quickly realized that this is a lot of work! After doing my first conversion "the hard way," I knew that the real problem was the technology and product limitations. When our installation work slowed down during the pandemic, I knew it was time to start designing a better solution. Now our "double hybrid" heat pump allows any home, with any system, to switch to geothermal without a full overhaul.

What makes your heat pump different from other heat pumps?

A traditional boiler supplies heat at 180 degrees. If you switch directly to a heat pump, which has a maximum temperature of 120 degrees, the heating system (baseboards, radiators) loses about 75% of its thermal capacity (i.e., its ability to heat the room). We solve this problem by producing hot water and hot air at the same time, with the same machine. This is our "double hybrid" patent pending design. Now, we can reuse the existing infrastructure without being limited by it. By passing cold air across the refrigerant, we significantly increase the efficiency of the system by 30 to 40%.

### You mentioned hot air, how does the hot air get into the house?

When installing our system in a typical house, we run ductwork in between the joists to supply hot air to the first finished floor. In most cases, we add three to four supply registers and one return. In heating mode, we blow a small volume of hot air so that the building does not feel drafty. Keep in mind, 85% or more of the heat is still coming from the home's baseboards or radiators. The ductwork typically takes one to two days to install and allows us to provide the home with air filtration, air conditioning, and heating.

### Your system does air conditioning too?

Yes, during the summer, the heat pump is very efficient at producing air conditioning. When our heat pump runs, hot water is a by-product and we use this to pre-heat the domestic hot water.

So, customers basically get free domestic hot water in the summertime?

Pre-heated hot water, but yes, it's a nice bonus for our customers. A typical geothermal system might be able to do that, but it would require a separate tank and additional components. This feature is built into every one of our products. Our product is designed by contractors, for contractors.

### Tell us about your demo sites.

We have five fully installed demonstration sites in the New York Capital Region. These range from 1,500 square feet to 6,000 square feet. We have a range of homes from new construction to a home built in the 1840s. Our first demo site is in a new construction residential property in Saratoga. It is the only home of our five sites that is new construction. Our prototype has exceeded our expectations for efficiency and performance.

Where do you go from here?

Our five demo sites are NYSERDA-sponsored. We will be receiving third-party verification of performance and efficiency from KW Engineering. We are officially launching our product in March 2022 for retail sale and offering contractor training sessions Q1 and Q2

*Cont'd on p.27*

# Renovated Peterborough Town Library Building is Heated and Cooled with Wood Chips

*Jim Van Valkenburgh*

The town of Peterborough, New Hampshire just celebrated the opening of their newly renovated library. Work was completed in September after more than a year of demolition and construction. It is a stunning building with some interesting innovations.

Multiple goals were set for and accomplished by Ann Beha Architects of Boston. Among them were a well-lit, warm and welcoming building with separate spaces for adults and children, a 100-person meeting room that can be used after library hours, and a sunny outdoor patio to take advantage of the building's setting, right beside the fast-flowing Contoocook River. The result is a lovely new building that is much more usable in the current era where libraries are places of information, group meetings and social connections.

The new library has a similar footprint to that of the old building which was mostly demolished. Only the classic 1890s library building on the corner of Main and Concord Streets was saved from the wrecking ball. This distinguished building was designed by Robert Morison, a nationally renowned mechanical engineer who was born and raised in Peterborough, but at the time had offices in Boston, New York and Chicago. Removal of the outdated 1957 and 1977 additions provided a blank slate for the architects to work with.

An old house that sits across the parking lot was and will remain the library's used bookstore, but the rear portion was transformed into the library's new boiler room. This is where an innovative dried wood chip boiler and absorption chiller were installed—key elements of a compelling innovation at the library. It is one that could be used in buildings across northern New England: the use of a wood pellet or wood chip boiler as the source of both heating and cooling.

*The rear section and basement of the Kyes-Sage House was converted into the boiler room for the new Peterborough Town Library. Pipes run from there, under the driveway and into library's HVAC system. (Photos: Froling Energy)*

How do you cool with a boiler? A high efficiency Froling T4-150 dried wood chip boiler generates 190-degree Fahrenheit hot water and stores it in a 600-gallon buffer tank. When an area of the library needs heat, circulators pull hot water from the tank and send it through the pipes to where it is needed. When an area requires cooling, hot water from the buffer tank is circulated through a Yazaki 10-ton absorption chiller which outputs chilled water that is also pumped over to the library. Yes, it is true: the absorption cycle creates cool water from hot water like a heat pump but it uses water as the refrigerant. It doesn't use any CFCs, so absorption is a very climate-friendly way to cool. (Get more info at www.yazakienergy.com)

Four buried insulated pipes run under the driveway to the new library: two are supply and return pipes for heated water and another pair is for chilled water. These run to air handlers placed throughout the building for delivering heating or cooling, as needed.

The entire boiler and HVAC system was designed by Wilson Engineering and installed by Froling Energy. Partial funding for the absorption chiller was from a grant from the NH Department of Energy. The biomass boiler system is generating NH Class 1 Thermal RECs which reduces heating costs down to $6.25 per MMBTU. The absorption cooling system is 10% less costly to operate than the standard electrically powered chillers. A large solar array is now on the roof of the new addition, with a capacity of 71 kilowatts, installed by Revision Energy.

Residents of Peterborough are excited about their new library building. The innovations within it set a good example with its energy efficiency and use of renewables. At the last town meeting residents approved a resolution that set the goal to have 100% renewable electricity for all by 2030 and 100% renewable heating, cooling and transportation by 2050.

*Jim Van Valkenburgh is the Vice President of Marketing at Froling Energy.* ♻


*Froling Energy's blower truck delivering the first load of precision dry wood chips into the Peterborough Town Library's silo behind Kyes-Sage House.*



## Geothermal "Game Changer"

– *Cont'd from p.26*

*Heat pump with air handler, blue storage tank on the right.*

2022. These training sessions will ensure there are reliable installers who know our product.

### How could a reader get involved?

Come to our scheduled walkthroughs at our demonstration sites. Scheduled walkthroughs will take place 1/11/2022 in Saratoga, 1/13/22 in Hoosick Falls and 1/18/22 in Averill Park. We invite all who are interested to come check out our technology in action.

This winter, Energy Catalyst is offering a thermal capacity audit for residential properties. We will measure the thermal capacity of your home over the winter months in order to take the first step towards switching to geothermal. The audit costs $300 but the $300 will be applied as a credit towards an Energy Catalyst heat pump. Anyone interested can email energy.catalyst.tech@gmail.com or call them at 802-793-0863. ♻

# Getting to Net Zero Everything: Part 1

*Sara Gutterman*

*This three-part blog series outlines the urgent need to transition to net-zero energy, water, and carbon. Part 1 highlights the net-zero energy imperative.*

The built environment is one of the most conspicuously consumptive industries and has a tremendous impact on carbon and other greenhouse gas emissions. The sourcing and manufacturing of materials, construction process, and operations of homes and buildings require an immense amount of energy and emit a substantial amount of pollution.

The Department of Energy (DOE) estimates that homes and buildings in the U.S. account for 40% of our nation's total energy use, 70% of electricity use, and 40% of total emissions.

On a global scale, it's expected that 2 trillion square feet (equal to the built environment in New York City) will be constructed every 35 days for the next 35 years, which makes getting to zero emissions an absolute imperative.

Fortunately, the transition to net-zero energy in the built environment is underway, irrespective of location, climate, and political jurisdiction.

The return on investment of net-zero energy homes is penciling out in markets throughout the nation, yielding quick payback periods for efficiency upgrades, as well as enhanced experiences for occupants, lower ongoing operations and maintenance costs, and higher resale values.

## Efficiency First

Any conversation about getting to net zero must begin with energy efficiency.

According to C.R. Herro, renowned building scientist and Executive Vice President of Operations at better homes, net-zero-energy "must-haves" include:

- High-performance, well-insulated, air-tight envelope on all 6 sides of the structure
- Super-efficient, right-sized HVAC system
- Good windows with energy performance ratios of less than 0.25U (U factor refers to non-solar heat flow, the lower the better) and 0.25 solar heat gain coefficient (SHGC refers to shading ability, reducing summer cooling loads)
- Cost-effective, energy-efficient appliances and lighting
- Heat pump technologies for air and water heating
- Access to renewable energy (rooftop or community solar array or a grid-tied system)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Herro avows, "The DOE Zero Energy Ready Program is the most cost-effective way to get a building envelope to a HERS (home energy rating system) 40 score. Then, by specifying energy-efficient HVAC systems, water heaters, appliances, and lighting and sizing the best, most durable solar array to close the gap, you have a ready-to-go, performance-based, net-zero solution."

## Industry Challenges Driving Innovation

The construction industry (and the entire economy) has been crippled by soaring material costs, labor challenges, and material shortages. While these challenges are driving up the cost of a typical American home by up to $50,000 and pricing over 2 million U.S. households out of homes, they're also forcing a transformation that arguably has a beneficial outcome for performance and sustainability.

Building professionals have been compelled to rethink their approach to design and construction, making alternative building systems that were once considered out of reach, like insulated concrete forms (ICFs), structural insulated panels (SIPs), panelized wall systems, and prefab construction, a viable, cost-effective alternative.

Offsite-constructed building-envelope systems, panelized systems, and prefab units are generally designed for performance optimization, deploying best practices in a controlled setting, providing superior energy efficiency, consistency, resiliency, quality control, and waste reduction. As one example, Nudura's Plus Series ICFs can offer R values as high as R-48.

## Investments with a Payback

Beyond the building envelope, advances in HVAC systems, windows, solar, and smart controls are further facilitating the transition to zero.

Heating and cooling systems account for approximately 55% of household energy use, so it makes sense to invest in high-performance technology, such as variable speed heat pumps.

While heat pumps have existed in the global market for almost 30 years, they are now reaching a tipping point in the U.S. due to a blend of technology advancements, enhanced codes, incentives, consumer awareness, and builder or contractor education.

Today's advanced heat pumps use approximately one third of the energy for heating and cooling than conventional technologies, and newer heat pumps can operate in extreme temperatures. Furthermore, developments in variable speed motors mean that heat pumps can run quietly and ramp up/down easily, making them more flexible, viable for integration with renewable power sources, and longer-lasting.

HVAC manufacturers are not only making systems more energy efficient, they're also creating solutions that safeguard indoor air quality, such as the AccuClean Whole-Home Air Filtration system by American Standard, which can reportedly remove up to 99.9% of harmful airborne particles, such as bacteria, pollen, and even COVID, in 30 minutes.

Windows and doors, generally the weakest portion of a building envelope, also play a major role in getting to zero. Up to 30% of a typical American home's energy can escape out of the windows and doors, representing an estimated $50 billion dollars in annual energy leakage in the U.S.!

Standard windows used today have an R-value between R-3 and R-5. According to the Department of Energy, increasing from R-3 to R-5 will reduce the average heat loss in a home by 30 to 40% (depending on the climate zone.)

While high-efficiency windows can cost anywhere between $70 and $150/sf (compared to basic vinyl framed windows, which cost between $25 and $70/sf,) the upfront investment yields a relatively quick payback period and then nets positive for a homeowner in perpetuity.

## Demand-Side Energy Management

Load flexibility and demand-side energy management (DSEM) have also become essential in the quest for zero. Smart devices enable load shifting (the ability to draw less energy from the grid during peak demand when energy costs are at their highest) to reduce grid stress and increase cost savings.

Utilities, municipalities, and cities across the country are implementing DSEM programs, with the highest adoption in

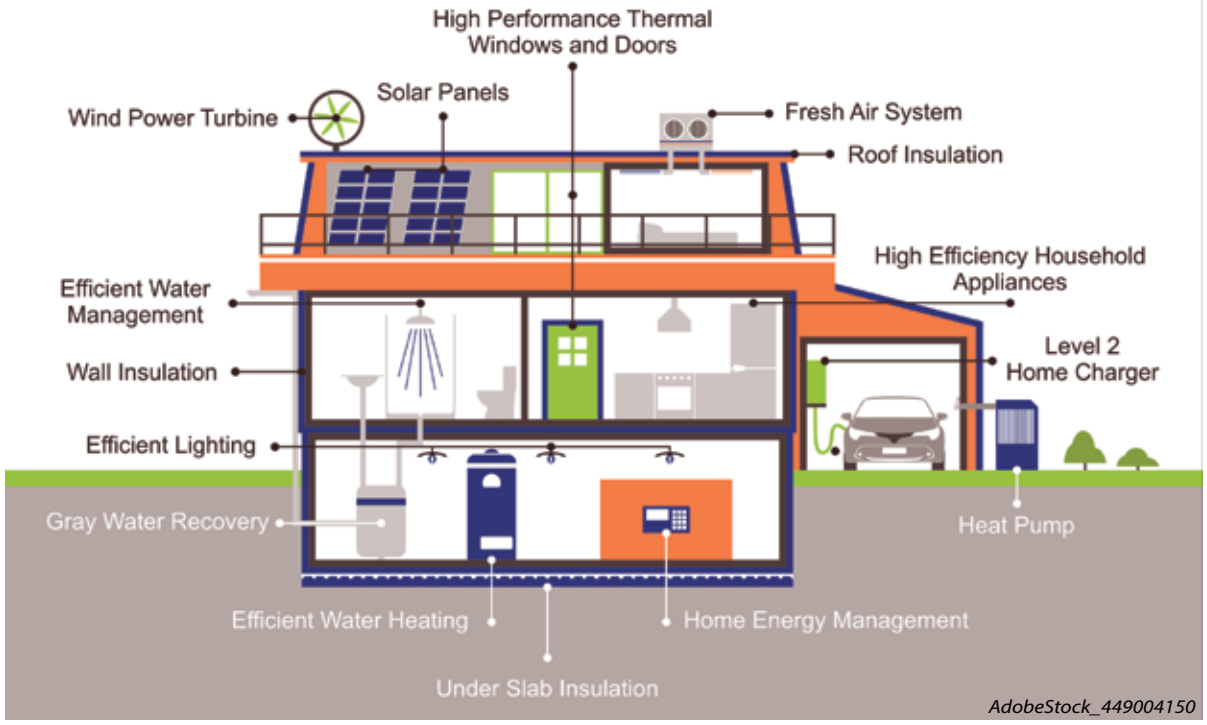
*Cont'd on p.29*

*Cont'd from p.28*

states like California, New York, Vermont, Washington, Oregon, Colorado, Minnesota, and Utah.

Advanced energy monitoring devices, like Schneider Electric's Wiser smart home power monitor , allow homes and buildings to have a sophisticated dialogue with the grid for optimized load-shifting.

And breakthrough technology, like Amber's solid-state power management system, can digitally control the electricity use of every device and endpoint in a structure, enabling any home or building to seamlessly add automated functionality to outlets, security systems, circuit breakers, lighting fixtures, appliances, and dimmer switches.



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## Renewable Energy Revolution

To get to zero, we need a full-scale adoption of renewable energy, namely wind and solar, as well as the adaptation of infrastructure, regulations, and financing vehicles to support the transition.

Fortunately, the clean energy future is already here. Wind and solar energy are now cost-competitive in most parts of the world, and clean energy technologies can now harvest more power using less space and fewer resources than ever before.

In fact, studies by Environment America show that solar panels and wind turbines are approximately 40% more efficient than those produced a decade ago. In the same timeframe, the cost of wind power has dropped by 71% and utility-scale solar by 90%.

To complement advances in solar and wind technology, the battery storage market is evolving at breakneck speed. The cost per watt-hour of utility-scale battery storage has fallen dramatically, down 70% since 2015.

## Electrification

As we transition to net-zero energy, we're also shifting to full electrification in the built environment.

Electric homes are not a new concept in the U.S. In fact, according to the U.S. Energy Information Administration, nearly 40% of all homes nationwide are all-electric, most of which are located in the South.

Jurisdictions across the country are requiring new homes and commercial buildings to electrify. Fifty-one municipalities in California (including Berkley, San Luis Obispo, Mountainview, Sunnyvale, Santa Monica, and Oakland) have created codes that ban natural gas hookups or incentives, like density bonuses, for builders/developers who choose to go all-electric. Cities in New York, Massachusetts, Oregon, Texas, New Mexico, Washington, and Louisiana are following suit.

The electrification of homes is expected to increase worldwide over the next decade, with a projected market growth from $2.4 billion in 2020 to $12.9 billion in 2029 for electrified home technologies such as air-source heat pumps, heat pump water heaters, and induction cooking technologies.

According to the EPA, the switch to an all-electric built environment will reduce our national emissions by approximately 560 million tons of CO2 each year.

## Codes in Play

While increased consumer demand for climate solutions and bold corporate environmental, social, and governance (ESG) commitments are accelerating the transition to zero, ratcheted codes are the true keystone.

California, the harbinger of all things sustainable, is marrying its energy code with decarbonization targets. According to Andrew McAllister, Commissioner at the California Energy Commission, the State has adopted a strict version of the 2022 energy code (set to be implemented in January 2023) and has set its sights on decarbonizing its electric grid by 2040.

To further align the energy code with decarbonization, California has adopted a new way to value energy costs—rather than just deploying a use-cost metric (which is a time-dependent valuation to measure the average cost of energy over time), the state is now incorporating a second metric that tracks source energy (tracing power back to its source), which provides a more accurate assessment of carbon emissions.

"We can no longer separate net zero energy from net zero carbon," insists McCalister.

And his words could not be more accurate—while getting to net-zero energy is paramount if we're going to reach our climate goals, the cold, hard truth is that net-zero energy is not enough.

To even have a remote chance at remaining under a 2ºC temperature increase, we must eliminate carbon emissions from the entire building lifecycle, from product sourcing to construction, operations to end-of-life uses.

How do we do that? Look for answers in the next installments of this Net Zero Everything blog series.

To learn more about getting to net-zero energy, water, and carbon, watch Green Builder Media's recent webinar at www.youtu.be/BQEGLOgLHeY.

*Sara Gutterman is the cofounder and CEO of Green Builder Media.*

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

# The Wingnut Testing Collective

*Nate Gusakov*

Yup, you read that right – I'm talking about a bunch of Wingnuts in a column about B.S. Still with me? Good. In this episode, you'll get a sneak preview of a very informal, yet hopefully somewhat helpful new organization that will be officially debuting with a presentation and meeting at Efficiency Vermont's Better Buildings by Design Conference in February 2022 (https://www.efficiencyvermont.com/trade-partners/bbd): the Wingnut Testing Collective or WTC.

As I write this shortly before Thanksgiving 2021, the roll-call of Wingnuts in the WTC is quite short: Old farts #1 and #2, and me, the slightly younger. Well, you get the idea. By this time next year, we hope there are dozens of Wingnuts chiming in from all over the region. The original Wingnuts are Peter Yost and Dave Gauthier. These guys have building science street cred – they've been fighting the good fight for a long while right here in New England, and they have acronyms after their names and charm to boot.


*Original Wingnuts Peter Yost and Dave Gauthier hard at work creating a test panel for WTC's first project of 2022 -- see their website (www.goose52.wixsite.com/wingnut) for more details! (Courtesy photos)*

If you take a quick look at Peter's website (https://building-wright.com/), you'll see things like "Lecturer for Yale University's graduate program," "an adjunct faculty with the UMass Dept. of Building Construction and Technology", and fancy letters like "LEED AP; BECxP; and "CxA+BE." What all this adds up to is that the guy knows his building science, and he knows what products are being used on the ground by modern construction companies. Dave has been an industry pioneer in laminated panel building technologies, works as a building science consultant, and still cares enough about this B.S. to show up for volunteer testing projects that label him as an official Wingnut.

Here's Peter's explanation of the birth of the original Wingnut Test Facility (or WTF):

> "Most testing done in the building industry is done in labs under carefully prescribed and controlled environments, having NOTHING to do with what takes place in the real world.
>
> Certainly, a bit tongue-in-cheek, I (and my longtime friend and colleague, Dave Gauthier) started the 'Wingnut Test Facility.' Working on the weekends and usually with responsible alcohol use involved, we set about developing test procedures that did not require fancy equipment and that mimicked field conditions.
>
> We fully expected to be either laughed off at any building professional meeting or be sued by building product manufacturers whose products we were testing. But to our surprise, WTF was taken seriously and even appreciated."

After attending Peter's virtual presentation about Wingnut Testing at last year's BBD Conference (one of the most well-attended presentations of the conference) and hearing his call for future Wingnuts to pick up the cause, I had a characteristically foolish moment of willingness and excitement. I sent an email to Peter who mumbled something about a sucker being born every minute and then gladly replied, and the WTC was born.

We intend the WTC to be an online hub for real-world, home-brewed testing projects that are relevant to today's builders, contractors, and architects. Nothing funded by corporations, nothing overseen by the ASTM or Underwriter's Laboratories.

*Cont'd on p.31*

*Cont'd from p.30*


*A sneak preview of a test panel for 2022's first project. Check out their website (www.goose52.wixsite.com/wingnut) or register for the Better Buildings by Design Conference 2022 to see more.*

The overseers of the WTC are just the folks who use this stuff every day, check out our projects online, and comment and ask questions. We have a draft website up already, which we invite you to check out: https://goose52.wixsite.com/wingnut.

There are pictures and narratives of past Wingnut projects, as well as an opportunity to sign up and comment on past and future projects. We hope you'll check it out, chime in with your opinions, and come see us at BBD 2022!

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

# ITHACA DECARBONIZE NEWSFLASH

*Dan Antonioli*

On November 3, Ithaca, NY once again made green building history by boldly approving a program to "decarbonize" all of its 6,000-plus buildings. Ithaca's city government (aka Common Council) voted unanimously for this measure and the city's Director of Sustainability, Luis Aguirre-Torres has tapped Brooklyn-based BlocPower to assist in this endeavor.

*Downtown Ithaca, NY (Flickr/James Willamor)*

Coinciding with COPS26, this measure, (the formal name is the Energy Efficiency Retrofitting and Thermal Load Electrification Program) aims to remove all forms of gas, oil, and coal energy used for heating and cooking, as well as electricity that relies on carbon energy for generation. A lofty, expensive goal, but one worth pursuing.

What does it mean to "decarbonize a building?" Although "carbon" is a widely misapplied word these days, it usually refers to an energy source that uses a carbon-based fuel at the point-of-use, carbon at the point of generation (such as coal), and carbon that is both generation and consumption (such as natural gas). Carbon is thus the dominant fuel source infrastructure that proliferated abundantly with the Industrial Revolution and to the present day is everywhere. And we're addicted to it and don't even know it.

So how do we get off the stuff?

How can we reign in a lumbering unconscious behemoth of a monster that's sleepwalking across the world and bumping into everything in its path? Well, don't worry—there's hope!

Brooklyn-based energy startup BlocPower claims to have "greened" over a thousand buildings and generally what they are referring to as "greening" is making the switch from natural gas heating to heat pump heating and heat pump cooling. BlocPower claims they can help Ithaca kick the carbon habit.

The announcement to decarbonize all of Ithaca's buildings has created quite a stir, with a flurry of confusion as to what it really means and how it's going to get done. Some homeowners think they're going to be "forced" to trade in their gas boiler for a heat pump they can't afford and believe that this is nothing more than Big Brother using sustainability as a trojan horse to exercise control. Others see this as a landmark sustainability move that has notable green building figures none other than Robert Watson proclaiming that he's "completely thrilled" and that this could "change the world." This puts Ithaca at the forefront of the green building movement.

Change the world? Sounds good to me, but how? Isn't going green expensive?

Greening buildings means a whole lot of things, but at this junction in green building history one of the basic building blocks of the decarbonization transition is the switch from gas heating systems to heat pumps, and it's that simple. And it's not cheap. So how is this going to be done? And what if the heat pump is powered by electricity that's generated by coal or gas-fired power plants or river damaging hydroelectric dams?

To achieve this transition Luis Aguirre-Torress and BlocPower have a plan to utilize private equity, low risk loans, and leasing options for building owners to finance the switch. Thus, the mechanism that's going to "decarbonize" a building is the financing of heat pumps and the promise that they will save money in the long run. And basically, this means that the greening of Ithaca will depend on the bottom line—money.

Can BlocPower, private equity, and heat pump leases save the day, save consumers money, and help Ithaca achieve the larger goal of decarbonizing the city's economy by 2030? And where do weatherization, solar panels, and occupant behavior fit in to the building equation? Luis Aguirre-Torres concludes that the effort to decarbonize Ithaca's buildings is less of an environmental agenda and more of an economic plan, and for now that's the plan.

In the next issue we'll do the math, follow the money, and take a nuanced look at how decarbonization is going to work in Ithaca.Dan Antonioli is a green developer, licensed general building contractor, and permaculture designer based in Ithaca, NY. His company, Going Green, is available to assist in a wide variety of green building projects. Visit www.going-green.com. ♻

# Green Street Commons: Goals of Energy Efficiency and Clean Energy.

*George Harvey*

Many parents of children with developmental disabilities face a common problem. They love their children and provide for them. But as they age, they often see their children's future as potentially insecure. A good life insurance policy might help, but questions remain about how needs will be met in a way that allows their children to lead an enjoyable, fulfilling life.

*Residents of Green Street Commons in Lebanon, NH. This is an energy-efficient home for adults with developmental or similar disabilities. (Visions)*

In 2014, Sylvia and David Dow founded a 501c3 non-profit organization, Visions for Creative Housing Solutions (Visions), to provide support for individuals with developmental and other disabilities. Visions has a statement of its goal at its website, visionsnh.org. It says, "Our goal is to proactively address an orderly transition of care for adults with developmental and similar disabilities from their aging parents to a stable, reliable and caring environment. We provide each individual with wrap around supports that are conducive to long-term friendships and a sense of well-being and self-worth."

Sylvia Dow used her family's property in Enfield, New Hampshire to provide a caring home for some of those with special needs. Sunrise Farm is now a place where twelve special people can live happy and productive lives in a rural area with flower and vegetable gardens, hiking trails, a swimming pool, and comfortable living quarters with individual sleeping quarters and shared living areas.

Visions was not formed to operate just the Sunrise Farm. There is a need for many more places like Sunrise Farm. So, Sylvia and David Dow soon set about raising funds for a new facility. Their efforts led to Visions being able to buy two buildings on Green Street, in Lebanon, New Hampshire.

As hard as financing and buying buildings was, in some respects the heavy work was just a beginning. Visions' Sylvia Dow was joined by Christopher Kennedy and Rebecca Gordon of MA+KE Architects; energy consultants Resilient Buildings Group, headed by Dana Nute; construction managers Estes & Gallup, led by Tim Estes; Ryan Lacey of Lacey Engineering; and financing consultants Nickerson Development Services, Inc. in collaboration with JEller Consulting, LLC. They set about designing and building the upgrades that would be needed to turn the new facility, Green Street Commons, into a comfortable home for those who would live there.

Their work was guided by goals of energy efficiency and use of clean energy. Windows and doors would exceed applicable code. A new wall with X two-by-four studs was built inside the existing exterior to provide for added cellulose insulation. The attic got eighteen inches of cellulose. All the insulation exceeded code requirements by a fair margin.

A good building envelope, with new air sealing, was needed because the old oil boilers were being removed, and the project team wanted the new heating and cooling systems to be as small, simple, and energy efficient as possible. Both buildings had new high efficiency Mitsubishi air-source heat pumps installed for heating and cooling. The heat pumps have a heating coefficient of performance (COP) as high as four, which means they can deliver about four times the amount of heat than an electric resistance heater could using the same amount of power. The heating COP drops as it gets colder outside. The systems installed maintain a COP of about 2.3 when outside temperatures are 0°F, which is still more efficient than electric resistance.

The buildings have new RenewAire energy recovery ventilators which constantly draw exhaust from

*Cont'd on p.38*

*Many thanks to our Sponsors:*

# NATION'S FIRST STUDENT-DRAFTED CAP

## Hanover, New Hampshire High School

*Jessie Haas*

Hanover High School (HHS) in Hanover, NH is the first high school in the United States to implement a student-designed Climate Action Plan (CAP). The CAP began with a discussion between HHS Earth Systems teacher Jeannie Kornfeld and her daughter Hannah, an HHS alumna who is an air quality and climate change specialist at Ascent Environmental, which prepares CAPs and greenhouse gas (GHG) reduction strategies for municipalities throughout California. Jeannie wondered if a high school Earth Systems class could create a CAP. "It sure could," Hannah said, and she was available to help.

The project got its start in the 2016-17 school year. The Earth Systems class and the buildings and grounds manager worked together to follow the process, which includes creating a baseline inventory, setting an emission target, developing a plan, implementing the plan, and monitoring the results. Hannah Kornfeld donated her time and expertise to guide students and Buildings and Grounds in creating the inventory; the high school's Environmental Club is now managing the plan.

The inventory revealed that the building generated about 45% of HHS emissions. The woodchip heating system was both the richest target, and the easiest one to tackle. The emissions were originally calculated at 1,462 metric tons of GHGs annually, projected to hold steady into 2050, the target date of the CAP. A request for proposals was written by students in the Environmental Club for sustainably-sourced wood chips and was released by the Buildings and Grounds manager. Two companies responded, and the manager chose Cousineau Forest Products of Henniker, NH.


*The extinct species cemetery at Hanover High School makes the point about the Sixth Extinction now underway. (Jeannie Kornfield, Environmental Club Adviser)*

That looked like a big, early win. But recently the impact of the wood chip boiler, and the reduction from this change, have been recalculated. When the CAP was drafted, biomass emissions were counted exactly as if they had been produced by fossil fuels. However, within the climate planning community there has been a change in how biomass emissions are calculated. As a result, HHS emissions have been recalculated to show anthropogenic emissions (i.e., fossil fuels, which are part of the long-term carbon cycle) versus biogenic emissions (i.e., biomass, in this case wood chips, which are part of the short-term carbon cycle.)

Taking this into account, the impact of switching to a sustainable wood chip source is much smaller. However, the wood chips the school is using are now meeting many of the criteria laid out in the RFP. Building energy from fossil fuel sources accounts for only 22% of emissions, versus transportation at a total of 76%. This necessitates a switch in focus. Jeannie Kornfeld said, "We are now focusing more on GHG emissions associated with travel by staff and students. This means figuring out how to get access to electric school buses, and adding solar on the school with the goal of using that solar for electric vehicle (EV) charging stations for teachers, as well as electricity to be used for heat pumps, some of which have already been installed in the school. In a poll sent out to teachers asking, 'Would you be in favor of having EV charging stations at Hanover High School?' 83% of the 55 teachers that responded replied yes. When we asked, 'Would you be more inclined to buy an EV knowing that there would be charging stations at HHS?' 50% of the teachers responded yes. This leads us to believe we could reduce carbon emissions associated with teachers driving to school by offering EV charging stations."

The infrastructure bill recently passed by Congress and signed into law by President Biden may help provide funding for projects like this. The Build Back Better bill, still being negotiated as of this writing, should also provide funding for climate mitigation projects.

Meanwhile, the Environmental Club is mapping the lighting system of the school, with the intention of replacing older units with LEDs. This will have a comparatively small impact on emissions, but represents low-hanging fruit, and is a project that has the enthusiastic support of Buildings and Grounds personnel.

Other projects the Environmental Club has undertaken in the past few years include a major educational effort around recycling and composting; an extinct species cemetery, making the point about the Sixth Extinction now underway; a pollinator garden that was established several years ago and is highly popular with local insects; removal of invasive species on school grounds; and an Earth Day celebration. For Earth Day, students and staff planted 400 red oak and silver maple saplings in the Mink Brook Conservation Area located next to HHS. As we are all learning, trees have a dramatic, long-term impact on carbon sequestration and global warming mitigation.

Environmental justice has been a strong interest for the students, and is an element that is currently being written into the CAP.

Kornfeld believes the process helps the students feel empowered in a bleak situation, and teaches them that they can contribute in a meaningful way. The Club is small; only about a dozen members consistently attend. They've already had a disproportionate impact yet it can be a challenge to get the whole school to know the CAP even exists, and it's hard to get the word out when the group only meets once a week for forty minutes. As a public school with resources such as access to a consultant who writes CAPs professionally, the Environmental Club feels an obligation to make the CAP available to other schools across the county who are interested in developing their own CAPs. The Environmental Club hopes that by the end of the current school year, the CAP will be posted on the Schools for Climate Action website: https://schools-forclimateaction.weebly.com/.

*Source links available in the posting of this article on the* Green Energy Times *website.*

*Jessie Haas has lived in a tiny, off-grid cabin in southern Vermont for over 35 years. She's the author of 41 books, including THE HUNGRY PLACE.* ♻


*Hanover High School's Environmental Club sponsored a Trash on the Lawn Day event. ((Jeannie Kornfield, Environmental Club Adviser, September 2019)*

*Earth Day 2021 tree planting event at Hanover High School. (Jeannie Kornfield, Environmental Club Adviser)*

# RESOURCES

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

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

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

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

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

**Carbon Tax: carbontax.org**

**Clean Energy NH: www.cleanenergynh.org/**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Renewable Energy World: www.renewableenergyworld.com**

**Renewable Energy Vermont: www.revermont.org**

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

**SmartPower: www.smartpower.org**

**Solar Components: www.solar-components.com**

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

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

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

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

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

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

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

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

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

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***Deadline for the next issue is Feb. 1, 2022.***

# LATE BREAKING NEWS

One thing that has stood out in recent news is a study by Dr. Mark Z. Jacobson, a professor of civil and environmental engineering at Stanford University. He concluded that wind, solar, hydro powered grids, with energy storage, could meet all the demands for energy in the United States, without risks of blackouts in any region. That may be a surprising conclusion to many people, but Dr. Jacobson is a well-known and highly respected source for peer-reviewed studies on how to address the problem of climate change.

His study gives us a source we can cite to counter the many voices saying that we will never be able to end our dependence on fossil fuels absolutely. One of the problems we have countering such voices is that they speak from a position of what they regard as common sense, and the things some people regard as obviously true often turn out to be wrong.

Jacobson goes further than just saying we can end our use of oil, coal, gas, and nuclear power. He says that we can do it without risks of blackouts "in any region." That is important because we do have risk of blackout from the huge power plants that are characteristic of the fossil age, and occasionally, they have hit us badly, with large areas of the country in blackout for extended periods. Dr. Jacobson is giving us hope for better things.

Readers who wish to learn more can visit the article, "Grid stability and 100% renewables," at *PV Magazine* (www.bit.ly/PVM-Grid-stability). ♻

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ELMORE ROOTS' PERMACULTURE KNOW-HOW

# It's Raining Cats and Dogs and Walnuts

*David Fried*

*Inside the green husk is a black walnut. Doesn't it look like it comes from Mars? (David Fried)*

Black walnut trees were rare in northern Vermont when I first looked around in the late 70s. There were a few in a cemetery in East Calais, and two on an old farm in Woodbury. Friends and customers later showed me some prolific ones in Burlington near the university. I used to collect black walnuts as they rolled down north street in Montpelier and settled along the curb. I watched that tree get larger and hoped no one would come in the night to cut it down. There are stories like that, as the wood is very valuable, but I don't want anyone to get any ideas.

Black walnuts grow easily from seed. Just ask any squirrel. The squirrel forgets most of the places she buries the nuts in the fall, so in spring they are growing into trees. This will be helpful to the squirrel's grandchildren of course, and to ours.

If you are planting black walnuts, use seed or young trees grown successfully near where you live. Plant them 20 to30 feet apart and to the north of other gardens or fruit trees, as they will get tall and shade out other plants north of them. Each tree can bear many buckets of nuts. It takes about ten years to get the first ones, but then it is a steady flow each October.

If you come across a black walnut tree and you are allowed to harvest some, here are the steps:

1. Get them before the squirrels! Use your hands or a rake or a nut wizard tool to gather them up. Float them in a bucket of water. The ones that sink should have good nuts and the ones that float won't. Take the ones that have settled and spread them out on the gravel or asphalt and start lightly stomping on them to get the green husks off. Put on your work gloves, as the husks are used as a natural wool dye, and they also naturally dye your hands very quickly. Pick up the inside hard black nuts and put them in a five-gallon bucket. Sweep the husks away to use for mulch or dry them for herbal use later.
2. Now run the hard inner nuts that came out of the husks under water and stir, stir, stir with a two-by-four or wooden handle. Change the water once or twice until you can see the ridges appear on the inner hard nut shells. Then pour them into an onion sack or other bag that drains well and hang in a basement or attic, so they will dry. Put some newspaper under the bag so the floor does not get stained black. Shake the bag once in a while to get air moving through them. After about two months, they are ready to crack and eat.

Black walnuts will keep for two years or so unopened. Once cracked open, store nut meats in the fridge. Do not try a nutcracker on these, as you might use on a hazelnut or pine nut or English walnut. Remember, these are the hardy Vermont black walnuts! You need a hammer and a rock, or a vise or a special heavy duty black walnut cracker to get to the nut meats.

But what a reward is waiting for you inside! Sparkling rich full nutmeats with high nut fat content and a high-quality oil. You can use a nut picker to gently pry out the nut meats from the inner shell.

Vermonters like to press these black walnuts into fudge or maple dishes.

You can make a nut pie similar to a pecan pie, but with black walnuts.

They are excellent to eat fresh.

They do not taste like the thin shelled store walnuts.

These black walnuts are mysterious, richly flavored and deeply satisfying.

I have never seen them for sale in stores.

You can grow them so easily and have your own store of high-quality protein source right in your front or backyard. The squirrels and I recommend you plant at least three trees, as two are needed for pollination to get nuts and the third will both help you get more nuts and also be a backup pollinator should one of your trees get sat on by a bear or a moose.

Just as they say about firewood, a black walnut warms you three times:

Gathering them and husking them.

Washing them and drying them.

Cracking them and eating them.

And a fourth time if you include persuading the moose to get up off one of your small trees.

*David Fried runs Elmore Roots Nursery where they grow a lot of young walnut trees from their large proven hardy ones.* ♻



Ingredient of the Month

# DON'T BLAME THE COW

*Larry Plesent*

Twenty years ago, a young man took upon himself the mission of expanding inner city gardens. He wanted to do this for all the right reasons. He wanted to create fresh food, knowledge of where our nourishment comes from and a safe green neighborhood environment. What he envisioned was both a respite and a teaching center. The young man was bright and earnest and he had a college degree.

And so he was able to write an application and obtain a grant and create a pilot project mini-farm in a dense city environment. He grew vegetables and turned compost and tried to connect with his new neighbors. He engaged anyone who showed the slightest interest.

His pocket farm had chickens and he gave away their eggs. But there was little interest in his fresh produce and questionable dirty eggs. He looked like just another crazy white boy on a mission.

As part of the project, he also obtained a small cow. This one came with udders.

It was the cow that piqued the notice of the neighborhood kids who seemed to spend all of their waking hours on the street. They were "udderly" fascinated when he milked the cow. Those kids had no idea this was where milk came from! He drunk a cup of fresh warm milk to show them that it was safe. Of course, the kids wanted to try some too.

My acquaintance had been drinking the milk for almost two weeks with no ill effect, and he knew his sanitation procedures were good. So, with the daring of the young, he offered it up. To his surprise the kids loved the stuff. They really, really loved it and seemed to thrive on it too.

Soon he had children lining up and down the block waiting for a cup of fresh milk. He had to get another cow, which soon gave birth to another. Wonders of nature.

His generosity had created a feeding program for a place where children are sent out for the day without a meal or the means to obtain one. He was a one-man Peace Corp creating healthier smarter more self-assured young people with at least a basic knowledge of agriculture. The project also created lots of manure. And THAT created a manure load of complaints.

Being of scientific bent (this is a true story after all) he knew that while cows generate a lot of methane (36% of species generated methane currently), methane is odorless. Manure clearly is not.

He began experimenting with natural feed additives to see if he could find something that lessened the sharp stench of fresh cow poop. Somebody in the seaweed business suggested adding small amounts of edible seaweed to the cow's feed. When they got to about 5% not only did the cows seem to enjoy the treat; the poopy smell was reduced by 95%.

Holy manure Agro-man!

Eventually the grant ran out. And anyway, feeding raw milk to children, despite clear and obvious benefits is a no-no in polite circles and at various state and local health-guarding agencies blind to 10,000 years of agriculture. In the end he was forced to move on. But now our hero had a new mission. He wanted to spread the word of the amazing poopy smell annulling powers of seaweed. In one clean sweep his discovery virtually eliminated a major drawback to concentrated animal agriculture.

He began traveling to organic conferences offering his advice to anyone who would listen. That's when I met him at NOFA-NY in Saratoga, NY.

It was a dark and stormy night with snow piling up against the windows of the conference hall as he slowly told me his story. His solution was elegant, natural, nutritious, and helped to mitigate the encroachment of human developments in areas formerly used only for agriculture. But it had one major drawback and it stared us both in the face.

The human love affair with bovine domesticus, that ravenous living machine that turns hay, grain and water into milk, meat, methane and manure had a larger appetite then fast-growing seaweed can keep up with. His solution would quickly become part of the problem.

The last I heard, our hero was working in the world of sustainable seaweed, mostly for human consumption.

This parable is a kind of Zen story. A question with no answer anyone in their right mind (actually it's the left) can answer. Each answer creates another problem. That's because all of us are part of an eco-system. No part can be fully separated from the whole. One hand clapping and all that.

If each of us make our acts of creation and consumption as natural, local, and sustainable as we can in the moment, we will collectively make a huge difference. This positive action also allows other people to see themselves (for example) driving electric cars or manufacturing their own electricity from light, wind and water. Or living in super insulated houses. Or maybe finally trying some kale. Perhaps even volunteering time to help others more messed up than ourselves.

This is also a story of hope and heroism. All of us have a rippling effect of influence, like a stone dropped into still water sending waves out in ever-widening circles. What type of ripples will YOUR life make?

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

# Gifts that Go Green for Your Holidays

*Janis Petzel, M.D.*

Looking for gift ideas this year that will not only please the recipient but will ease the path to a greener world, and which won't create (much) pollution or trash? Here's a list to inspire your creativity. The idea is to reduce consumerism as much as possible while keeping the environment in mind when we do buy things. We focus here on gifts to individuals but encourage everyone to also think about gifts to the community in the form of volunteering, public service and general kindness to one another.

### The Gift of Warmth:

Donate money or time to make energy-saving insulated window inserts with Window Dressers (windowdressers.org) to benefit members of your community. Mainers can amplify their gifts via Power-Market*

### For the Do-It-Yourselfer:

(Wikimedia)

- Old fashioned rotary eggbeater
- Clothes pins or drying rack
- Window films to protect birds from collisions (Audubon Society has great information)
- Food dehydrator
- Glass food storage containers with non-plastic lids
- Kitchen compost container and outdoor receptacle
- Worm culture composter kit
- Rechargeable electric tools (drills, weed whackers, lawnmowers, chain saws. etc)
- Seeds or seedlings

### To Save Money on Electricity or to Turn Down the Thermostat:

- Community Solar membership (see powermarket.io). Mainers can amplify this gift*
- Programmable thermostat
- Wool socks or sweaters (bonus points if you make them yourself)
- Comforters
- Insulated window shades
- LED lightbulbs
- Kill a Watt meter to measure energy use by gadgets and appliances

### Delicious Food or Support a Local Farmer:

We are blessed to have beautiful local produce, beer, breads, cider, cheeses, jams and jellies, maple syrup, pickles, sustainably raised meats, seafood, shellfish, sea veggies, and wine all from the loving hard work of local people. All great gifts. If you don't grow your own or make items yourself, support a local producer.


### For a child:

- Books and time to read together
- A special outing to the library to get the child's own library card, or for story hour
- Art and craft supplies and journals (non-electronic)
- A bicycle and helmet
- Outdoor experiences
- Start a child-sized garden outdoors or on your windowsill
- Plant a tree. As the tree and the child grow, add a swing
- Look at the stars together
- Teach the child to swim or kayak or camp or hike or hunt

### Gifts of Time or Experience:

- Help someone put in a garden or a place to compost
- Share a meal
- Help put up a clothesline
- Park or botanical garden passes

### Gifts of Knowledge and Inspiration:

- Memberships: My favorites are MOFGA, Wild Seed Project and The American Chestnut Foundation, but whatever group is important to you and your loved ones
- Books: My favorites include Will Bonsall's Essential Guide to Radical, Self-Reliant Gardening by Will Bonsall; Animal, Vegetable, Miracle by Barbara Kingsolver and family; Blowout by Rachel Maddow; Finding the Mother Tree by Suzanne Simard; Bringing Nature Home and Nature's Best Hope both by Doug Tallamy

### Extravagant or Legacy gifts:

- Electric bicycle
- Solar panels
- Batteries to go with solar panels
- Upgrades to a house—insulation, heat pump, new windows, etc.
- An all-electric vehicle or truck

Himiway Ebike (Unsplashed)

### *Bonus combo for Mainers:

- PowerMarket (powermarket.io/) will donate $100 to Window Dressers for each new community solar membership in Maine if you include the promo code INSERTS on page 1 of your application.

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

# Stratton Mountain, VT Signs On For Solar Power

*Wallingford, Vermont Community Solar Array (Courtesy photo)*

Stratton Mountain Resort (Stratton) has entered a power-purchase agreement to be the recipient of solar energy produced by Sea Oak Capital's 500-kilowatt AC solar array in Wallingford, Vermont. Located 40 miles north of Stratton Mountain, the newly completed solar array has the ability to generate approximately 1,000,000 kilowatt hours annually. This places Stratton Mountain among the leaders of Vermont ski areas in regard to solar energy production in the state.

How much energy is 1,000,000-kilowatt hours? Annually, 1,000,000 kilowatt hours are enough energy to power the entire Sun Bowl Area, the Welcome Center, all retail and dining locations in the Stratton Village, the Stratton Training and Fitness Center, and the Child Care Center, with some kilowatt hours to spare.

The power purchase agreement is another step in Stratton Mountain's commitment to increase the resort's overall renewable energy mix. Currently, the resort as a whole is powered by 64% renewable energy, defined as wind and solar energy in Vermont, and the overall energy mix produced is 94% carbon free. The solar production from this new array began in July 2021.

"At Stratton we are excited about this long-term partnership with Sea Oak as it represents continued action in our ongoing commitment to environmental responsibility; a key strategic initiative for not only Stratton, but also Alterra Mountain Company, and our industry as a whole. Partnerships and investments like this one help not only an individual organization meet its sustainability goals, but also provide opportunities for the local region to improve its environmental footprint" said Bill Nupp, Stratton Mountain Resort's president.

"We look forward to our long-term partnership with Stratton Mountain Resort and congratulate them on their commitment to environmental responsibility and sustainability," said Dan Poydenis, Chief Executive Officer of Sea Oak Capital. "The Wallingford solar project is our seventh Vermont solar project in the last twelve months, and further demonstrates our commitment to assisting the state and local businesses in achieving their renewable energy goals."

This power purchase agreement shows Stratton's commitment to being a leader in efficiency and sustainability in the ski industry and support of the further integration of renewable energy into the Vermont power grid. "We are committed to a role of environmental leadership across all areas of business. It is a priority and responsibility of Stratton to be stewards of the natural environment in which we live, work, and play by incorporating a sustainable point of view into every business decision" says Stratton Mountain Resort's Sustainability Manager, Connor O'Sullivan.

Learn more at seaoakcapital.com and stratton.com. ♻

# Ice Fishing 101

*Kenneth Reaves*

Though factors such as climate change, pollution, and invasive species have long threatened the sport of angling, it looks like ice fishing is here to stay. As northern climates continue to welcome an abundance of prize-worthy catches, anglers from all over the country flock to states like Michigan, North Dakota, and Minnesota.

If you are new to the art of fishing, its icy counterparts can prove a challenging learning curve. In this quick guide, you'll learn how to make the most of your time on the ice.

*A little boy fishing on a frozen lake. (AdobeStock_191502048/Oleh)*

## What is Ice Fishing?

Ice fishing involves hooking or spearing catch through an opening in the ice on a frozen body of water. You can ice fish in any area whose lakes, piers, or ponds experience regular freezing. Most ice fishing activity in the U.S. takes place in one third of northern states.

## The Best Equipment for Ice Fishing

To get started ice fishing, you'll need to stock up on the following staples.

### Rods

Most ice fishing rods are smaller than traditional products and measure between 18 and 26 inches long. Because of their compact stature, shorter rods allow anglers to jig more effectively.

Equip your rod with a sturdy reel to avoid having to pull up your line by hand.

### Lures and Bait

During the winter, the sun sets earlier than usual. A reflective lure will attract any fish's attention.

Pair your lure with live, pungent bait such as wax worms, maggots, spikes, wigglers, or minnows. Attaching a brightly colored jig can help lure in your catch.

### Augers

Naturally, to gain access to the water, you'll have to cut through the ice to begin with. You can choose between manual or electric-powered augers, the former of which is more affordable and easier to maintain. However, electric drills are more convenient and can save you a lot of time—you can even drill as deep as 130 feet!

## Types of Catch You'll Come Across When Ice Fishing

Hook-and-line ice anglers will most likely come across these fish species.

### Crappie

Crappie is among the most sought-after species when ice fishing. However, because they frequently migrate during the winter, keeping up with their movements can be challenging. When ice fishing for crappie, drill as many holes as possible to better your chances.

### Perch

During the peak winter season, schooling perch provides days of non-stop action. However, these fussy fish won't always fall for even the tastiest of bait. Prioritize high-quality jigs when traditional baits don't get the job done.

### Trout

Rainbow trout are prevalent and recognizable, even outside the ice fishing sphere. But don't underestimate them—these ice fish can put up an impressive fight! When ice fishing for trout, the key is patience!

## How to Stay Safe on the Ice

Naturally, to stay safe on the ice, you'll want to go in the proper clothing. Wear something to keep you warm throughout the day, and consider setting up shelter.

Take along safety spikes in case you fall into the water. This bit of equipment can be life-saving.

Finally, familiarize yourself with the regulations in your designated ice fishing destinations. Some laws enforce specific limits and size requirements—all for the sake of your safety.

## Where to Go Ice Fishing

Ice fishing is arguably the most exciting thing you can do all winter, especially if you frequent the following regions:

**Vermont:** This destination is home to a healthy variety of fish species such as bluegill, pike, and walleye.

**New Hampshire:** During the winter, you won't find any shortage of makeshift shelters on the ice in New Hampshire. Don't forget to pick up your fishing license—you can apply through NHFG's many licensing agents!

**Maine:** Ice anglers flock to this lucrative fishing destination rich with delicious salmon and lake trout. Hire one of Maine's knowledgeable angling experts for a praiseworthy catch!

*Man successfully ice fishing with an auger and needs setup on skis. (USFWS)*

## The Bottom Line

If you're keen on visiting a lucrative ice fishing destination like New Hampshire, Maine, Vermont, and Eastern New York, becoming well-versed in the different kinds of gear and safety regulations in your area can make for an enjoyable afternoon out on the ice.

Remember, ice fishing takes a lot of practice. Brutal weather and fish scarcity are just a few issues you might have to overcome—but they will be worth the battle!

*Reaves is an avid ice fisher and angling expert. As the owner of Perfect Captain, he is passionate about providing helpful resources to rookies and veterans alike.* ♻

# What Do Net-Zero Emissions Pledges Really Mean?

*George Harvey*

There is some good news on emissions. According to zero-tracker.net, 136 countries, 111 regions, 235 cities, and 681 large companies have made net-zero pledges. That covers 90% of the gross domestic products and 85% of the people on Earth.

Before we rest too easily, we should take a deeper look at what all that means. It is clearly possible that some of those emissions are going to net-zero only in the projections on paper, and might not go to net-zero in the real world. Unfortunately, the reasons that failures could happen are many, and the failures can happen in many ways, some of them not all that visible.

*Ørsted's Tunø Knob offshore windfarm(www.bit.ly/3cUFNaK). RhinoMind. CC-BY-SA 4.0. (www.bit.ly/38OKcvg)*

As a concept, the goal of net-zero emissions is not difficult to understand. It means that you might still have greenhouse gas (GHG) emissions, but you are making up for them by removing an equal value of emissions elsewhere.

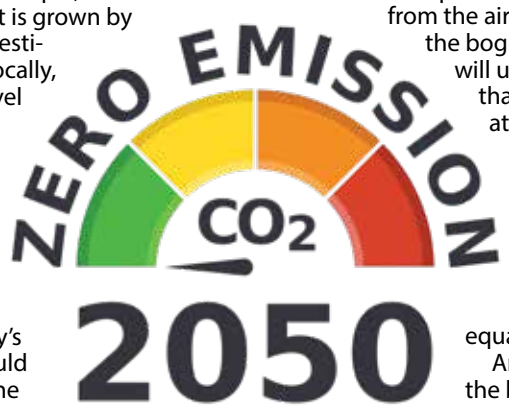
For example, if you are operating at net-zero and you want to fly to Europe, you could plant a number of trees to make up for the carbon emissions of the trip by drawing carbon dioxide ($CO_2$) out of the atmosphere. There are a couple of problems with this that are pretty easy to understand. The little trees will have to grow for years before they can draw down much $CO_2$. They can also burn down in a wildfire, putting the $CO_2$ back into the atmosphere, something that happened to trees Microsoft planted.

Things get more complicated than that when we examine the actions of companies and countries. To understand this, we should look at the various categories of emissions.

Level 1 emissions are those that are released directly by the consumer organization. Emissions from the use of heating oil is one example. The products arising when Gasoline is burned in a car is another.

Level 2 emissions are those that are released to make energy that the organization uses. Emissions connected to electricity or steam that is purchased for heat are examples.

Level 3 emissions are those that are emitted in the value chain of an organization's products. For example; if food sold in a supermarket is grown by hand, does not use pesticides, and is grown locally, the supermarket's level 3 emissions associated with that food would be very low, in contrast to level 3 emissions of conventionally-grown food brought in from far away. An oil company's level 3 emissions would be high because of the nature of its product.




Let's take a look at that. The company extracting oil, the refiner, the pipeline owner, delivery truck owner, and so on all have that oil in the level 3 emissions. It sounds like it is counted several times over. Actually, it is, and each operation in the chain should be aware that it has to be reduced. But it is the level 1 emitter who ultimately has control of whether the emission happens. If you drive a gasmobile, you are a level 1 emitter, and it is an issue you control.

On the other hand, let's look at a peat harvest. That looks pretty good from a cursory point of view. But a closer look tells us that peat removes a lot of $CO_2$ from the air. Removing it from the bog to use on a garden will ultimately allow that $CO_2$ to enter the atmosphere again, as a level 1 emission of the gardener. Leave it in the bog, and the peat does better drawing down carbon than an equal area of forest.

And sadly, that is just the beginning of the complexity of the net-zero story. Another, much more important issue is that the speed at which net-zero is approached has a huge impact on the planet. Here, we can go into the real meat of the issue.

Suppose a big oil company says it will have net zero emissions by 2050. And suppose its plan is to sell as much oil as possible until 2045 and then sell everything it owns, distribute the money to its shareholders, and go out of business. That is a plan for net-zero by 2050. It is also so disingenuous that we might best call it a hoax.

We are not trying to say that net-zero is a useless goal. We are trying to point out that it has to be transparently planned in such a way to reduce emissions of GHGs as quickly as possible.

There are companies that have already made major progress, and these could be held up as examples. A really good example is Danish Oil and Natural Gas. That name described its business, until it decided to go clean. It started to convert to renewable energy, not just to power its operations but to sell the electricity it made. It changed its name to DONG. Since then, it has divested its last holdings in fossil fuels and changed its name to Ørsted. Now it is the largest owner of offshore wind farms in the world.

We can do this, but we have to be smart. ♻

## Green Street Commons – Cont'd from p.32

bathrooms and kitchens and provide 100% outdoor air to bedrooms and living spaces. The exhaust air and outside air pass through a static plate heat exchanger that recovers about 70% of the energy being exhausted to temper the incoming outside air without the use of additional energy.

*Green Street Commons in Lebanon, NH is an energy-efficient home for adults with developmental or similar disabilities (Visions)*

All appliances are Energy Star rated. Lighting was replaced with LEDs. The lighting units in hallways are dimmed to 30% most of the time, and motion detectors turn them up to 100% whenever people are present.

Renovation construction work began in November 2020 and was completed in November 2021 when several final parts ordered last January arrived and could be installed. One of the last things that needed to be done was blower door tests. These were performed by Resilient Buildings Group, which got results of 3.2 air changes per hour (ACH), a value that far exceeds the 7.0 ACH code requirement.

Eleven residents moved into the Green Street Commons in July and August. The facility also has a staff that includes a house manager, a resident manager, personal mentors providing individualized supports for residents, overnight staff, an on-call registered nurse, and a property manager.

Funding for the Green Street Commons was provided by New Hampshire Housing Finance Authority, Federal Home Loan Bank of Boston, and Mascoma Savings Bank and the many generous large and small donors to Visions' Green Street Capital Campaign. It also got a sizeable rebate from Liberty because of its energy efficiency measures. ♻

# Who is Responsible for Recycling?

*Roger Lohr*

Who is responsible for recycling to reduce plastic, cardboard and paper packaging waste – those who use products or those who produce products? Recent articles in the *New York Times* and Associated Press informed about the Natural Resources Council of Maine program to address the volatile commodities recycling market that would charge product producers a fee based on factors such as product packaging tonnage. Funds would be paid into a state-run, non-profit producer responsibility organization. These funds would be used to reimburse municipal governments for their recycling operations. In July 2021, The Maine governor signed into law the Extended Producer Responsibility for Packaging legislation to initiate a program in Maine. Similar programs have been developed in Europe, Japan, South Korea and five Canadian provinces. In the U.S. similar legislated programs are pending with Oregon and six other states, while four additional states have expressed interest to join the movement.


According to the Product Stewardship Institute, a growing movement in the U.S. seeks to ensure that those who design, manufacture, sell, and use consumer products take responsibility for reducing negative impacts to the economy, environment, public health, and worker safety. These impacts can occur throughout the lifecycle of a product and its packaging, and are associated with energy and materials consumption; waste generation; toxic substances; greenhouse gases; and other air and water emissions. In a product stewardship approach, manufacturers that design products and specify packaging have the greatest ability, and therefore greatest responsibility, to reduce these impacts by attempting to incorporate the full lifecycle costs into the cost of doing business.

The concept of the extended product responsibility (EPR) program is to cover municipal recycling operation costs and to provide an incentive for companies to reconsider the design materials used in packaging. There would be higher fees for hard to recycle packaging. Companies can lower their payments by implementing their own independent recycling programs or simply by reducing packaging. There are currently 33 states with some form of EPR law, but most are very narrow (limited to for example, mattresses or paint). The *New York Times* article stated that since 2008 the state of Connecticut has diverted 26 million pounds of waste, and consumer price increases related to recycling were found to be $0.0056 per pound in an Oregon study.

In Ireland, paper and plastic recycling rates have increased from 19% in the year 2000 to 65% in 2017 and many European Union countries have attained 60 to80% rates. According to the Product Stewardship Institute, the U.S. has had a 32% decline in the recycling rate which was affected by the 2017 Chinese decision to stop importing other nations' plastic recyclables.

By the way, plastics consume about 20% of all the oil that is produced. While these facts are important, an example of the relevance of these recycling issues is that in Oregon 44 cities and 12 counties have stopped collecting plastics to be recycled. The Maine program is expected to cover about 40% of the waste stream in Maine. It is also expected that the law will help to make recycling programs across the state more uniform.


*Left: (EPR graphic: advancedwastesolutions.ca); above: (Recycling-closed-sign-Gail-Thompson)*

The packaging and retail industry organizations are opposed to EPR programs on various grounds. These organizations favor incentives to create new markets for recycling materials. Their view is that there is too much government authority and that if such a program is to be instituted that it would be better managed by the industry. Support has been pledged for these EPR programs among many organizations in the product stewardship community and even some companies such as Coke, Walmart, and Unilever. It remains to be seen if some product companies will opt to pull out of states where there are EPR programs or pass on the costs to consumers.


*Recycle, Reduce, Reuse painting gets noticed. (Kevin Dooley/Flickr Creative Commons)*

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

## GREEN RESOLUTIONS FOR 2022 – *Cont'd from p. 1*


*Adobe Stock_ 306593310/HollyHarry*

- Vote.
- Support and volunteer for environmental and social justice advocacy groups. It's almost impossible to keep up with events and legislation without a broad network of watchful eyes.
- Social justice matters, support it. Sustainability requires healthy communities with a fair and equitable distribution of resources and opportunities.
- The squeaky wheel gets the grease. Let your elected officials at the local, state and federal levels know what you think, and the bills you support.

**3. Consumer Mindfulness**: When asked the question, "How much money is enough?" oil titan John D. Rockefeller is infamous for answering, "Just a little bit more." But the more you have, the higher your personal contribution to global carbon pollution is likely to be. Time to think, "Maybe a little less."

- Money can't buy you love, part 1: What are you buying when you buy stuff? A cheap thrill? Or something that will add real value to your life? The easiest way to tell is to wait a day or two. If the purchase still seems like a good idea, maybe it is.
- Conservation of energy: Make a game of it. Every Sunday this winter, turn down your thermostat by 1 degree (and more at night). You'll be surprised what you can comfortably adapt to if you go slow. Next, see how low you can get your kilowatt hour (kWh) usage on your power bill. Can you beat 30 kWh per day, the national average? Can you get to 10? To 5? Turn off lights, use a drying rack rather than the clothes dryer, wear a sweater, close your shades on cold nights, get LED lightbulbs, and invest in insulation. Invest in solar and renewable energy options.
- Waste not, want not. It's fun and gratifying to swap, reuse, upcycle, and extend the lives of stuff, and to reduce the amount of trash your household creates.
- Avoid food waste. American consumers waste 30% of the food grown in this country, which means we waste the water and fossil fuels used to grow and transport them. Big fridges are where leftovers disappear to decompose unless you pay attention.
- Stop eating oil. Shifting away from an industrial agriculture, meat-heavy diet to a plant-focused diet is healthful for you and for the planet. Eat food grown as close to home as you can, in the least processed form. If you're able, support local farmers who use regenerative agriculture methods.

**4. Your Personal Infrastructure:** Fossil fuels are used directly when we build our homes, heat and cool them, and for transportation.

*Your efforts to conserve energy and to avoid fossil fuel use do make a difference. Here, clothes dry on a drying rack in front of the woodstove. (Dave Petzel)*

- Money can't buy love, part 2 (but it can buy solar panels). Get yourself some solar panels! Or buy into a community solar farm. Or subscribe to electricity from a solar garden. Then, over time, replace your gas- or oil-burning appliances with efficient electric models. Solar is a solid investment especially as electric rates go up. (In Maine rates may increase 60-80% in 2022 for Versant and CMP customers.)
- For new construction, take the time to make fossil fuel-free choices.
- Can you cut back on how much you drive your car for some of the year? Walk, ride a bike or an e-bike, carpool, or use public transportation.
- Electric vehicles: Test drive an all-electric battery vehicle (BEV). Car dealerships need to see that customers are interested. When your current vehicle dies, plan to replace it with a BEV.

**5. A Healthy, Sustainable Human Ecosystem Requires Community.** You have it in your hands to make a difference for yourself, your family and for others, and for the world. Pick a place to start. There is no time like the present.

*Source links available in the posting of this article on the* Green Energy Times *website, greenenergytimes.org.*

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