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The 2022 Beijing Olympic Games are set to be the most environmentally green to date.

G.E.T. staff

To maintain this high level of carbon neutrality, some technical measures are being implemented. A "Winter Olympics Carbon Measurement" platform is being used. This allows a real time measurement of carbon emissions by all the stadiums.

Every one of the 26 Olympic venues will be completely powered by renewable energy. Construction is minimized by reusing five venues from the 2008 Olympic games. In addition, low-carbon transport is being used. The goal is to keep the Olympic games carbon-neutral. The expectation is to reduce the overall carbon output by 950,000 tons.

Green Energy Times wishes best of luck to the Olympic Games in reaching its environmental goals and to all the athletes in their competitions! ♻️

How Much Will the Climate Crisis Cost?

George Harvey

There are many ways we could address the climate crisis. We could go into denial, despair and do nothing, or get into conflicts over resources. Or we could face the issue in a realistic manner and act on it vigorously. The course we are on now appears to be to acknowledge the problem, say we will address it soon, and continue favoring the interests of corporations.

Making sense of the cost of each possible approach is not something for the timid. Fortunately, there are research organizations that do that for us. McKinsey, a well-known global management consultancy, has recently published a report on the subject, "The net-zero transition: What it would cost, what it could bring." The report can be downloaded

Cont'd on p.25



Flooding is a huge climate concern. (Michael M. Stoke, CC-BY-SA 2.0, bit.ly/IDA-PA-flood)

THIS IS HOW YOU DO IT!

New York is Setting the Example on Tackling the Climate Emergency

Mike Bailey and George Harvey

On January 5, New York Governor Kathy Hochul gave her first State of the State address. In it, she outlined a plan for a "New Era for New York." The speech covered a wide array of topics, including the state's response to Covid-19 and a large number of programs set up to bring the state back to normal function. Her remarks can be read online at <https://on.ny.gov/3rtr7HM>, and the speech can be watched at C-SPAN at www.bit.ly/NY-State-of-State-2022.

She said a lot about energy and climate change, and she outlined a large number of things she planned for the State of New York to do about them. Her message was put out in a more condensed form in an email, which Green Energy Times has put online at www.bit.ly/GET-NYS-email. Here, are things we at Green Energy Times find most interesting among Gov. Hochul's many proposals:

Offshore Wind: New York State will put \$500 million into infrastructure to support the effort to install offshore wind farms. The goal is to install six gigawatts

(GW) of offshore wind power by 2030. Transmission will go directly to New York City. Building on the success of New York's award-winning Offshore Wind Master Plan, the New York State Energy Research and Development Authority (NYSERDA) will initiate a new master plan to unlock the next

frontier of offshore wind development.

Energy Storage: The state will also get 6 GW of energy storage by 2030. This storage capacity will be spread throughout the state. The deployment will be "backed by needed market reforms and cost-effective procurement

Cont'd on p.22



Kathy Hochul gives State of State address (Darren McGee, Office of Governor Kathy Hochul, via Flickr)

Children's Programming Needs to Tackle Climate Change

The topic is curiously absent from shows for kids

Tara Haelle

Last February, my kids were thrilled with the huge snowfall we had. It's rare to get snow in northern Texas, let alone enough to build snowmen and have snowball fights. But within days, the novelty had worn off, as the state grappled with the lowest temperatures in nearly a century. Millions had no power; hundreds died. "Climate change," my 11-year-old promptly replied when I asked if he knew what had caused the storm.

Whether they are stuck inside because of arctic temperatures in one of the country's hottest states, breathing smoke from rampaging wildfires across the West, or enduring a record-high Pacific Northwest heat wave, kids today are growing up in a world where the reality of climate change is inescapable. Most of them know—or will soon enough—that things are only going to get worse. What they don't know is how to process this reality, or what to do about it. Children's--oriented media has an important role to play in helping them prepare, but the topic of climate change has been largely absent from most children's shows. That needs to change.



Photo: Sam Murphy

"We want to create some awareness without overwhelming kids or making them afraid. The message really for kids is, 'Yes, this is happening, but through ingenuity and working together, we can solve problems.'"

"It's going to become more and more obvious that [climate change] is an issue we need to be tackling with our programming," science communication consultant Sara Poirier said. "Where [the industry] is missing the mark is on making it personally relevant to kids and showing that it's impacting things that they've actually experienced or care about."

There are some notable exceptions to the dearth of climate-change-related media for kids: *Nature Cat*, *Wild Kratts*, *The Octonauts*, *She-Ra and the Princesses of Power*, and *Paw Patrol* have all touched on themes that have to do with climate change. A few podcasts, such as NPR's *Wow in the World* and the UK's *Fun Kids Science Weekly*, explore aspects of it now and then, as does the occasional movie, like the recent *Bigfoot Family*, in which kids work to protect a wildlife reserve from an oil company. (The film raised the ire of Canadian energy lobbyists, who called it "full of lies and misinformation.") For the most

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

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

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

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Green Energy Times Distribution Team Help GET Save the Planet

PART FOUR IN OUR FEATURE SERIES

All of us at Green Energy Times are proud of the fact that our volunteers and workers do their part. Here are three more examples of their own stories.

Mark Koprowski – New Hampshire volunteer distributor



The Kropowski's 20kW solar system is enough to power the house, geothermal heating and cooling and 35 miles of electric driving per day. (Courtesy photo)

We have a solar system that is just shy of 20 KW, which is enough to power the house, geothermal heating and cooling and 35 miles of electric driving per day. We also have a Tesla S and Chevy Volt. The Tesla gets an MPGE of 103. The Volt 35 miles of range before gas engine kicks in.

We used Green block for the house construction (not just basement but walls as well) which gives an R-30 with no air infiltration. The house was built with poorly fitted fiberglass batts at an R-30 level in the attic. My wife and I rented a blower from Lowe's and installed an equivalent of R-65 (total with squeezed down fiberglass) of cellulose insulation on top of the fiberglass. A propane boiler still heats our water. We will install an air heat pump water heater in the future. The propane for this one-use costs us \$1.84/day. Last year, we bought a golf course. Thus far we have spent \$4,988 on gas for the carts and mowers. Our lease on the carts runs out in 2023. We will definitely go electric on the new lease for the carts and install roof and parking lot solar. Golf course mowers will be tough to go electric. Electric models are hard to find. We plan to visit "green" courses and see what they have done.

We use a self-propelled electric grass mower and weed wacker for the house and love them.

Concentration of CO₂ in the Atmosphere

419.33

parts per million (ppm)
February 8, 2022

Learn more at www.CO2.earth.

Tim Roper – Distribution volunteer, Chester, Vermont.

I've been an amateur ecologist for as long as I can remember, but it wasn't until entering the solar energy industry in 2007 that I began focusing on gradually lowering my emissions footprint. Since that time, we've added solar to our own home, installed heat pumps, insulated our home to exceed government recommended R-values, air-sealed the building envelope and purchased a plug-in hybrid vehicle. By adding battery backup to our home, we're also able to help supply the electric grid during peak demand events which further reduces the need for the utility to purchase oil and coal-fired electricity generation during those events.

Having played a role in driving solar adoption as a solar company sales director, I wanted to identify and help drive the next movement in reducing society's systemic emissions. That opportunity arose with the advent of high-quality electric lawn care equipment coming onto the market, prompting me to start an all-electric, solar powered and organic lawn and garden care company. My intent is to reduce my customers' lawn care related emissions and to create awareness of the technology's advantages, hopefully prompting others to make their own switch away from highly polluting gas- and diesel-powered lawn care equipment and into cleaner, electrically fueled machines.

As a result of these shifts, operating costs for our vehicles, equipment, home and business have all been cut drastically. The lesson: Gradually making sensible changes to reduce emissions is a big win-win-win! ♻️



The Ropers reduce their environmental footprint by using solar to power their home and heat pumps. One of the two heat pump condenser units is at the right side of the house. (Courtesy photo)

Earth Day 2022



While every day is Earth Day at *Green Energy Times*, we are always happy to see the renewed focus come as April 22nd approaches every year. The first

Earth Day happened on that date in 1970. In April, we see schools, communities, and businesses celebrate in their own ways to help protect our planet. The original Earth Day was viewed

as a teach-in at schools. It quickly grew to more than that (see www.bit.ly/GET-Earth-Day-2).

Earth Day's 2022 theme is *Invest in Our Planet™*. Everyone can make a difference. Visit <https://www.earthday.org/earth-day-2022/> to find information on Earth Day events, activities, and what individuals and organization can do to make a difference. The time to act is now. ♻️

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VERMONT'S DIRTY LITTLE SECRET: Our State Government is Anti-Renewable Energy

[Op-ed] Peter Sterling

Talk to anyone who has tried to bring renewable energy to Vermonters and they will tell you the same thing: despite our green reputation and the thousands of Vermonters who have asked for leadership to avoid the existential crisis climate change presents to humanity, our state government works every day to put the brakes on new solar energy and wind power projects.

The latest example is the draft Comprehensive Energy Plan from the Vermont Department of Public Service which will guide state energy policy for the next five years.

Facing massive demand for new electricity consumption that will be needed as Vermont reduces climate-changing fossil fuel use by electrifying its transportation and weatherization sectors, the Department's Plan:

- Makes no mention of using clean and reliable Vermont wind power;
- Fails to recommend any new in-state renewable energy use beyond the meager 10% already in state law;

- Whitewashes Vermont's loss of renewable energy jobs every year since 2016 when incentives for solar energy started being reduced;

- Inaccurately alleges that "Under any reasonable measure, the existing siting process allows well-sited generation projects to be built in Vermont."



Vermont State House (Flickr/Jim Bowen)

By failing to recognize the need for new, homegrown clean energy sources, undercounting the clean-energy job loss, and misrepresenting the significant challenges facing those trying to build clean energy projects on private land, the Department's plan is anything but "comprehensive."

The Vermont Public Utilities Commission (PUC), charged with permitting renewable energy projects, wrote the most restrictive statewide sound standard for wind power in the country – effectively banning new wind projects in Vermont by, for example, requiring wind turbines to be roughly 100 times quieter than the FAA's "strictest" sound level for F-35 jets.

Renewable Energy Vermont members have long documented how the current permitting process for solar projects is unpredictable and unnecessarily time consuming and expensive for all but the smallest size projects.

For example, the PUC rejected a solar project in Manchester stating, "The Project would have an undue adverse impact on aesthetics...[because] The duration of the view for drivers [passing by it] would be approximately 26 seconds" and that "approximately ten residences or businesses near or adjacent to the Project site would have visibility of the Project."

Similarly, the PUC denied a solar project proposed on a vacant, treeless lot next to an auto parts supply warehouse, self-storage facility and a gas station. The hearing officer denied the project because he reasoned that it would have an undue adverse effect on the aesthetics of the already heavily-developed area.

While these and other cases represent a relatively small number of denials, they have a substantial chilling effect on renewable energy developers and private landowners who abandon otherwise promising sites—including sites in already-developed areas where forest and other wildlife impacts are minimal—because of the uncertainty they create.

These project denials and other harmful PUC standards also harm our economy and our ability to fight climate

change. Since 2016, when the PUC started decreasing incentives for solar power, Vermont has lost 1,421 jobs in the renewable energy field.

One could imagine the Governor's office taking very direct action if say over 1,400 Vermonters lost their jobs in the ski industry or at Global Foundries over the last five years with no end in sight.

If our state government doesn't allow solar panels next to warehouses and gas stations because of aesthetics or doesn't think it's ok for drivers to spend 26 seconds looking at solar panels as they drive by, it is impossible to see how Vermont will reduce our fossil fuel use enough to do our part in stopping climate change.

To reduce greenhouse gas pollution, we know the future will require increased reliance on cleaner electricity to power our cars and heat our homes without burning dirty energy sources that are making our planet less safe for humanity. Vermonters need a state government that truly leads on the fight to stop climate change by removing barriers to electricity from clean, safe, reliable, and affordable in-state renewables like solar and wind power. But the record is clear, Vermonters are not getting what we need.

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

Vermont's Legislative Update: February 4, 2022

Lauren Hierl

On February 4, 2022, budget discussions were underway about how to **move forward the Climate Action Plan**, where we need to **invest at least \$150 million** in FY23 in programs to help Vermonters and our local communities get access to clean heating options; weatherize their homes, businesses and municipal buildings; access clean transportation; and build a clean energy workforce.

Check out the *Climate Dispatch* (<https://bit.ly/energy-reliance-initiative>) with Rep. Laura Sibilia to learn more about the Municipal Energy Resilience Initiative legislation (H.518). This bill would provide support and funding for municipalities to transition to cleaner and more efficient energy solutions.

We place continuing priority on the enactment of the **Transportation Innovation Act (H.552)**. This act dramatically increases investments in clean transportation solutions that will help Vermonters access more affordable and efficient options for getting around. Discussions are underway on a range of clean transportation policies in the Transportation Committees.

Work continued on the Clean

Heat Standard proposal in the House Energy & Technology Committee. A well-crafted **Clean Heat Standard** can help people access far cleaner and more affordable heating options. We must simultaneously invest in programs to help Vermonters weatherize their homes and switch to clean heating options.

Another key priority is enacting a strong **Environmental Justice policy**. Work on this bill (S.148) continued this week in the Senate Natural Resources & Energy Committee. It will take steps to help ensure that no segment of the population should suffer disproportionate environmental harm or lack access to environmental benefits.

It is important to note that we must also implement strategies to **improve our communities' climate resilience**. The Senate Natural Resources and Energy Committee continued working



on **Act 250 legislation (S. 234)**, which includes several provisions to promote smart growth and maintain intact forests. In addition, the House Natural Resources, Fish and Wildlife Committee continued working on a bill that would generally strengthen the Act 250 pro-

gram's ability to administer the review of natural resource impacts by bringing back an independent Environmental Review Board to run Act 250 (H.492).

The House Natural Resources, Fish and Wildlife Committee passed out a bill (H.697) to **promote the enrollment of old forests in Vermont's Current Use Program**. That bill is now in the Ways & Means Committee. The Natural Resources Committee also continued working on a bill (H.606) focused on developing a plan to promote community resilience and biodiversity protection by conserving 30% of our lands and waters by 2030. We also encourage the House Committee on Gen-

eral, Housing, and Military Affairs to continue working on the BIPOC Land Access and Opportunity Act.

A **clean water** bill to create a registry for water withdrawals, and build a permit program to protect water levels in Vermont's surface waters (H.466), passed the House, and now heads to the Senate.

Additionally, the Senate passed (30-0) a bill to hold **toxic polluters accountable (S.113)** for medical monitoring costs due to chemical exposure caused by a corporate polluter and allow the State of Vermont to sue manufacturers of chemicals that damage public facilities and natural resources. Read more at <https://bit.ly/toxic-contamination>. The bill now heads to the House Judiciary Committee.

Lauren Hierl is the executive director for Vermont Conservation Voters.

Source links:

February 4, 2022: *The Municipal Energy Resilience Initiatives* (<https://bit.ly/3B9IVvO>)

Vermont Senate Gives Initial Approval to Bill to Help Victims of Toxic Contamination (<https://bit.ly/3oB6vve>). ♻️

The Birth of the “Charging Across America” Challenge 2022

Eric Studer

Rob Swartz has a simple mission statement for each of his motorcycle businesses, “Make every client’s next ride their best one.” He is often referred to as the “motorcycle marriage counselor” since his client’s most frequent compliment is, “You made me fall in love with my bike all over again.”

Swartz was eight when his father’s friend taught him how to drive a 1925 Model T and said, “Take some laps kid.” Barely able to grasp both sides of the steering wheel or reach the pedals, Swartz proceeded to do exactly as instructed, driving countless circles around a rural airfield till the Speedster’s tank ran dry.



Rob Swartz and the record setting 1924 Ford Model T Speedster he built before he was old enough to drive.

Combining frugality, a multitude of odd jobs and a burning drive to go fast, Swartz owned three cars before getting a driver’s license. At 15, he built his first and favorite ride from spare and donated parts. It’s no surprise it was a 1924 Model T Speedster like the one he drove when he was eight. Decades later, Swartz still cruises the favorite Ford around his Gardner, Massachusetts hometown and races it at Loring Timing Association speed competitions and other events.

Opened in 2004, Rob’s Dyno Service (RDS) has grown to become New England’s premier motorcycle tuning facility for any internal combustion, electric or high-performance motorcycle. RDS also offers maintenance and repair services for any brand of motorcycle, in addition to components and accessories personally designed by Swartz.

Following the success of RDS, he opened MOTUS of New England (MONE) in 2017, selling and servicing MOTUS motorcycles,

a premium sport-touring bike produced from 2014 to 2018 in Birmingham, Alabama. MONE is the nation’s largest source of MOTUS parts and continues tuning, repairs and total rebuild services for this rare and coveted American-made bike.

Convinced that electric power will lead the future of transportation, Swartz opened one of America’s first Energica electric motorcycle dealerships in 2020. Energica of New England (EONE) is the only bike dealer offering an in-house Dynostar Dyno calibrated for testing, tuning and performance optimization for any internal combustion or electric motorcycle brand.

Dedication to ensuring client riding enjoyment led Swartz to designing parts and accessories found nowhere else. Swartz has consulting relationships with leading aftermarket and Original Equipment Manufacturers (OEM), including Energica Electric Motorcycles, Helibars, MOTUS motorcycles, Woodcraft and others to manufacture his custom designed components under the Rob’s Dyno Service brand.

His designs include front forks for select Indian models, in addition to LED light packages, foot pegs and handlebars for Energica electric motorcycles. His popular custom Indian front forks and rear shocks have popularized Swartz’ unique designs with dedicated riders around the globe.

Ever the promoter, Swartz is organizing the first-ever “Charging Across America Challenge” event. Swartz and co-rider Steven Day will attempt to break the Cannonball cross-country electric motorcycle record of 178 hours and 17 minutes piloting Energica electric motorcycles. Both riders will simultaneously ride coast-to-coast in opposite directions following the 2,906-mile route of the original Cannonball Run, creating a unique “race within a race.” The event starts April 18 with finish-line completion April 22 - EARTH DAY. The promotion is designed to accomplish three



Cross-country map for the “Charging Across America Challenge” following the original 2,906-mile route of the Cannonball Run from New York City to Redondo Beach, California. Below: The world’s fastest female motorcycle racer and “America’s Queen of Speed”, Valerie Thompson, celebrates top speed records with Rob Swartz and his Motus 1650cc at Bonneville Motorcycle Speed Trials 2021. (Images: Eric Studer)

primary goals:

- Change American consumer perceptions on viability of electric vehicles
- Build awareness of growing the national EV charging station network
- Demonstrate superiority of Energica’s zero-emission electric motorcycles vs. direct competitors and internal combustion-powered brands

This will be a fun and history-making event providing numerous tie-in and PR opportunities for savvy marketers seeking unique messaging for their brands. Professional videographers will follow both riders providing real time downloads during the 3+-day trek.

Swartz and his team are seeking financial support or in-kind contributions needed to offset event-marketing expenses. When he’s not servicing customer’s bikes or promoting zero-emission vehicles, you’ll find Rob at the racetrack tuning client’s bikes as well as his own. Today, he is a 21-time land speed record holder piloting his Ford Model T Speedster, a Dodge “company truck” named “The Beast” and of course, very fast motorcycles.

Eric Studer’s award-winning career is focused on building segment-leading brands like Holiday Inn, Red Roof Inn, Rent-A-Center, Hilton International and “America’s Queen of Speed” and the world’s fastest female motorcycle racer, Valerie Thompson. 🔄



CATERPILLAR’S ELECTRIC TRAIN



Most of us know about Caterpillar, a company that makes heavy equipment such as earth moving equipment and ore trucks. Caterpillar has a lot of divisions, one of which is Progress Rail, a manufacturer of diesel locomotives. The division now makes an all-electric locomotive, the EMD Joule. It has sold ten of them to the Union Pacific Railroad. We will doubtless have more about this in future issues. EMD Joule locomotive. (Progress Rail)

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

Interview with Tamara Boise, Owner of Cyclewise, Inc.

Cyclewise, Inc. is a 25-year-old powersport dealership, located in New Haven, Vermont.

G.E.T. Staff

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

Tamara Boise: My title is owner, operator, and enthusiast. My husband and I started Cyclewise, Inc. out of our passion for riding. Joe grew up on powersports and is a technician by trade, and I found joy in supporting and introducing the love of motorcycles to our customers. We believe that motorcycling creates a healthy lifestyle through experiences, adventures and creates lasting friendships.

When was your company started?

TB: We founded our business in 1997, so this is our 25th year in business.

How many dealerships does your company own?

TB: We have one location, one dealership which is constantly growing and changing to meet the needs of our customers.

About how many customers do you serve per year?

TB: Our customer base includes upstate New York, all of Vermont and branches



Tamara Boise, with a new electric Zero motorcycle

into many of the New England states. With our award-winning service and sales departments, and the area's largest apparel selection we serve hundreds of people per year. We encourage customers to gather at our dealership as a meeting place and ride destination.

How long have you been selling electric vehicles?

TB: We have been proudly selling zero motorcycles since 2014.

What percentage of customers come in looking for an electric vehicle? How has this changed over the past five years?

TB: We are seeing roughly 10% of our customer traffic looking for electric motorcycles. Some out of curiosity and looking to gain knowledge of the product, others that have done their research and are ready to purchase. Over the past five years interest has increased year over year. New charging capabilities and longer ranges have opened more options for the riders, and a new customer base from local municipalities has recently emerged. Police are starting to see the value for their departments both for moral and community outreach. It allows them to get to places currently only reachable by ATV's or on foot more quickly with less environmental impact.

How long have you been a member of the EEN? Are there customer benefits to you being an EEN member?

TB: We have partnered with Efficiency Vermont since 2014, and we recently became a member of their new EEN electric vehicle dealer trade group. Being an EEN member lets customers know we are a qualified electric vehicle dealership through Efficiency Vermont. We are recognized as a business able to help our customers meet their energy-efficiency needs.

What are some questions you recommend customers ask when looking to purchase an electric vehicle?

TB: We encourage everyone to ask for realistic charging times and realistic mileage ranges. There are many different styles of riding, and a more aggressive riding style can significantly affect the drive range. Be sure to ask about the cost of ownership referring to maintenance. Over time the electric vehicle is less costly than a gas engine. Inquire about what type of charging capabilities the vehicle has, for example level one, level two or three and what is available for charging upgrades. Be sure to know where the charge stations are and what charge levels they can accommodate. The level of charge reflects the time it takes to fully charge the battery.

Anything else you'd like to tell us about being an electric vehicle dealer?

TB: Being an electric vehicle dealer gives us the ability to satisfy the growing needs of our energy conscious customers. We have welcomed in many new customers who may not have considered a motorcycle as a mode of transportation. Now the electric motorcycle can supply them with savings and a green energy solution to support their way of life. It is so exciting to be on the forefront of innovative technology, we are thrilled to see what the near future brings in all segments of riding and style.🔋



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Vehicle Idling in the Winter

Wayne Michaud

Ugh, it's cold outside! And not only that, it snowed four inches last night. But, no matter, I have to drive the pickup truck into town to do a few errands. So, let's start her up and let it run for ten minutes or so to get the engine running nice and smooth, the interior toasty, and melt off some of the snow and ice as well.

The above scenario is fairly typical among us who drive internal combustion engine (ICE) vehicles during winter. Many drivers are unaware of the harm and waste of discretionary idling—that's idling when parked—a largely unnecessary practice, even in winter. Let's take a closer look as this has an impact on our vehicles, our health, the environment, and the law. Plus, we'll explore ways to minimize the idling impact.

Some facts on the impact of idling related to fuel use and maintenance costs:

- Idling a light-duty vehicle (compact, sedan, SUV, most pickups) burns 0.2 to 0.7 gallons an hour; for heavy-duty vehicles, one gallon an hour or more.
- Ten minutes of warm-up idling can cost \$40 to \$150 annually, depending on engine size.
- Idling a light-duty vehicle for more than ten seconds uses more fuel than shutting off the engine and restarting (30 seconds for heavy-duty vehicles).
- According to a U.S. DOE study, restarting up to ten times a day will not shorten starter life. Ever see an UPS truck idle while a driver makes a quick delivery? Probably not, as UPS's strict idle reduction policy reflects the fuel savings

benefits, over starter wear.

- Excessive idling causes needless engine wear. Besides the accumulation of "ghost" miles, the engine does not operate at peak temperature which causes carbon soot buildup on engine parts and the need of more frequent oil changes.

Another reason not to idle in Vermont, and in New Hampshire and Massachusetts as well, is that these states have laws that restrict the idling of all motor vehicles, not just heavy-duty diesel trucks and buses. Depending on the state, the law restricts idling to five to 15 minutes in any 60-minute period, with exemptions. So, what is the best, most efficient way to warm up a car in winter? First, be prepared for the cold! Clear off any snow and ice before starting the engine. Excepting families with frail elderly or infant passengers, from 32° to about 10° Fahrenheit, start the engine, blast the defroster, and let it idle for up to 30 seconds (in colder temperatures, one to three minutes). This will allow engine oil to fully circulate. Then, only if defrosting



Idling vehicles waste fuel and money. Idling also has a negative impact on our health and environment. (Photo: Flickr/MN Pollution Control Agency)

is adequate, drive the car under light to moderate acceleration for a minute or so before operating normally. These quick stationary warm-ups will allow the catalytic converter to begin its function of minimizing tailpipe toxins once the vehicle is traveling. The engine will get up to peak operating temperature faster. The car's heating system will work better. Yes, you will be cold for a few minutes, but you'll treat your car right, save some money, improve local air quality, and reduce some CO2 emissions each day. Here is a tip: consider investing in one of the several types of engine block heaters available, which will make starting easier on cold mornings.

Idling vehicles can have an impact on our health. Even modern ICE vehicles can emit harmful tailpipe toxins in circumstances such as warmups, in extreme temperature ranges, and when in a caravan of vehicles such as at school drop offs and pick ups. The U.S. EPA states: "Idling vehicles contribute to air pollution. Monitoring at schools has shown elevated levels of benzene, formaldehyde,

acetaldehyde and other air toxics [sic] during the afternoon hour coinciding with parents picking up their children. Children's lungs are still developing, and when they are exposed to elevated levels of these pollutants, children have an increased risk of developing asthma, respiratory problems and other adverse health effects."

School buses can be even more of a concern as their diesel exhaust contains higher levels of nitrogen oxide and fine particulates that can get into our lungs. New England states regulate the idling of school buses on school grounds to varying degrees. In general, they must warm up away from school buildings and not idle while children board or exit the buses at school, though there are exceptions for defrosting needs and in extreme cold.

What can we do to minimize the negative impacts of idling? Behaviorally, it's mostly a matter of following the advice in this article. What do we gain each day? Saving some money, being kinder to our cars, improving air quality, and reducing our carbon footprint. What do we sacrifice each day? About five minutes of comfort. Technologically, think of low-to zero-emission vehicles, the future of transportation. Right now, full hybrids are a good choice to minimize discretionary idling while leaving the engine on. Plug-in hybrids will all but eliminate idling and greatly curtail gas use. While all-electrics can have battery-range limitations in winter, by using no gas, no oil and emitting zero tailpipe toxins, they are a great choice for short to medium commutes.

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

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The Many Faces of Norwich Technologies: **NORWICH EV**

George Harvey

When Norwich Solar Technologies was founded, in 2011, it was already unique. The country is full of great solar designers and installers, people and companies that are truly impressive, but this company's leadership always wanted to do more. Its founders, Dr. Troy McBride and Dr. Joel Stettenheim, were ready to do some serious research and development (R&D). The goals were not just installing new systems, but building new types of systems.

Not long ago, in an interview, the co-founders expressed their thoughts about this. Chief Technology Officer Troy McBride said, "Our mission is still to rapidly develop promising clean technology solutions, that was us and it still is who we are today." Joel Stettenheim, the company's President, added "From the beginning it's really been about solving these problems but it's also, on the flip side, about finding opportunities. The problems are opportunities in many cases, and throughout our years in business our work in R&D has definitely been at the center."

It should be no surprise that Norwich Solar Technologies has been awarded grants from the U.S. Department of Energy. Its leadership members have also been awarded numerous patents for their inventions in the field. Clearly, while it is a solar company, at its core, it is a technology company. It is about innovation as much as about solar energy.

As the company grew, different missions emerged that took on special focus. The core business, now called Norwich Technologies (NT), is still the parent, and it still puts energy into original R&D but there are three other divisions in the company.

The first of these is Norwich Solar (NS). This is the same company we have known all these years, though now it is officially a division of Norwich Technologies. It designs and installs solar systems for schools, municipalities, businesses, farms, affordable housing providers, community solar projects, and nonprofits throughout the Northeast. NS has all the experience and resources to develop, finance, and install the systems its customers need. (We might mention that NS does not do residential installations.) The NS website is norwichsolar.com.

The second division of NT is Norwich EV (NEV). This division came into existence because company leaders could see that

the age of the electric vehicle (EV) is coming. There are many reasons for this, ranging from concerns about climate change to low cost and excellent safety of the vehicles.

One thing that could hold EVs back, however, is a lack of sites to charge them. While many EVs are charged using relatively low power systems at people's homes, there is no denying that people want to be able to know that they can go to the limit of their range, charge the car, and return. To do that, charging stations have to be commonly available.


Here is a problem – there were not enough EV chargers around. And in this case, the problem offered an opportunity, just as Dr. Stettenheim suggested it might. The opportunity was to get EV chargers set up in places where they would be needed.

There are a lot of reasons to put chargers in specific places. Drivers of EVs really appreciate the businesses that make chargers available. According to Clean Technology Project Manager Berrett Walter, "NEV's mission is to thoughtfully develop EV charging destinations in downtown locations that benefit both EV drivers and the host communities. By developing a strategic network of public charging stations, we hope to reduce range anxiety and encourage EV adoption!" There is a very big incentive for businesses to have them, and a very big opportunity.

Norwich offers more than just well-placed chargers. The quality of the chargers is important. Emerging Markets Engineer Jack Greene said, "NEV is bringing fast and convenient charging to New England to make EV ownership an easy choice."

NEV has even more than that to offer, however. Some businesses have fleets of vehicles. Fleets of EVs will need chargers on a large scale, and that will require significant thought and design. For that reason, Norwich EV has put an emphasis on installations for fleets.

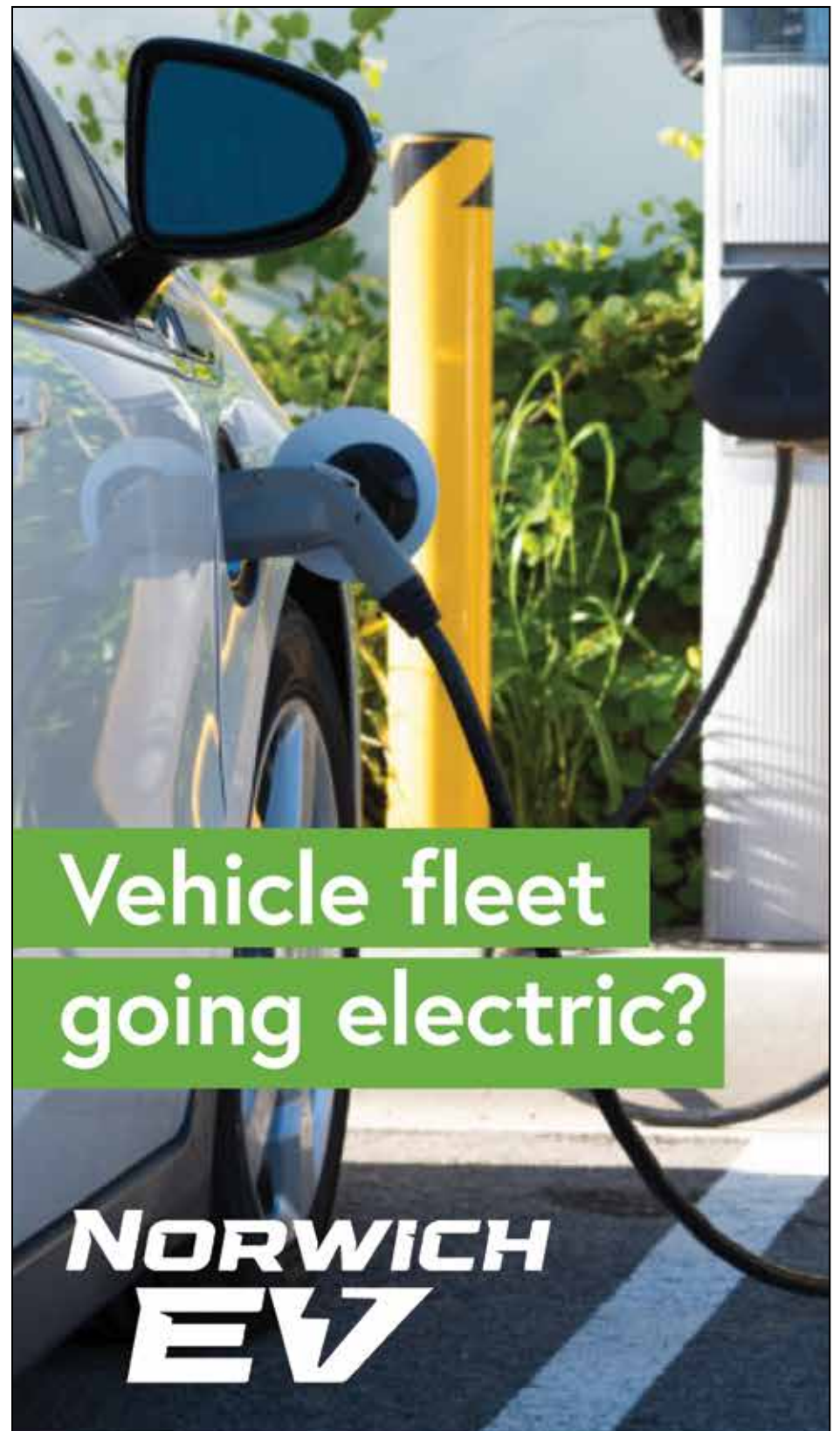
Just as other NT divisions, NEV has also dedicated some attention to project financing. The company's experience makes it possible for NEV to offer tailored solutions. We might finally add that car ports and parking lot solar are perfect places to offer EV chargers. And Norwich knows how to do that, too.

The NEV website is norwichev.com. 

Cont'd on p.8



Norwich EV charger installation at Orvis in Manchester, Vermont through the Green Mountain Power Workplace Charger Program. (Courtesy photo).



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The Many Faces of Norwich Technologies – Cont'd from p.7

RUNTIME SOLAR: AT YOUR SERVICE

As Norwich Technologies contemplated many global issues, their solutions offered them new opportunities. Starting RunTime Solar fulfilled a clear need for local, professional management and maintenance of solar assets. Managing a solar asset goes far beyond servicing a solar panel or inverter warranty, and includes a host of other jobs.

RunTime Solar's service can begin at commissioning the solar asset, and continue to end-of-life replacement or decommissioning. In between the entire system is maintained by experts; including inspections, monitoring, alerts, reports, all manner of maintenance, and overall management of the site. Anything that can reduce production is addressed by trained eyes and hands.

We asked Dan Kinney, the head of RunTime Solar (RTS) about the jobs he and his crew do. He started with site maintenance, saying that it included "everything from mowing and weed whacking to fence repair." But that was just a start.

Kinney said the mowers he uses can be big. One cut down saplings close to two inches thick. "The forest in New England is constantly trying to win, which is fine," he said, "but not near a solar panel." We



Runtime solar general manager, Dan Kinney, is always amidst solving an issue with his team. Right: trailer and mower for Runtime Solar's vegetative management obligations. Keeping a solar site well maintained is important to hitting your production goals. (Courtesy photos)

did ask about sheep keeping grass down, which is almost commonplace at some sites throughout the state. Kinney said, "We have looked at sheep. It looks good and everyone likes it, but we haven't found a shepherd who will do the job as economically as the mowers."

There is more to vegetation control, however, than cutting grass and saplings. Some of it involves identifying and controlling invasive species. "Part of what we do is vegetation management. Some of the sites have permits that require invasive species control. We bring in scientists to observe. I work on a variety of reports and it's all part of the operations

and maintenance service we provide." One especially important species to control Kinney mentioned was Japanese knotweed.

While much of the work relies on consistent physical on-site management, RunTime Solar harnesses the technology available to further address any reduction in production. Kinney said, "We maintain

Kinney commented, "We make most of our electricity during the harvest season." He explained that the bulk of production was in spring, summer, and fall. But doing the best really does include making the best of sunshine in the winter. Norwich Technologies has, with the help of their research and development team, deployed specific technologies that get the snow off the panels. We asked about how those technologies worked. It is proprietary information for now. Perhaps we will learn more in time.

Kinney suggested that RTS has around 130 assets under management, with the majority of these being installed by Norwich Solar. While some assets are as small as 30 kilowatts (kW), they generally range in sizes from 150kW to 500kW. Such systems need to be properly managed to get the best results, and so that they can continue to spread the benefits of local renewable energy generation to local communities for years to come.

"This is a real industry," Kinney said. "We have a really good staff with a lot of diversity." And it is an industry that needs new employees, as it is expanding, even during an age with Covid-19. "I am interested in hiring electricians," Kinney said. But he wants really good people who understand everything from computers to field work.

The RTS website is runtimesolar.com.



Local Vermont Custom Feed Store Goes Solar

Ajah Tier

Morrison's Custom Feeds is a leading feed processor and provider in New England with a processing mill and feed distribution facility in Barnet, VT. The Morrisons are a fifth-generation agricultural family that has been operating the mill for the last 30 years. The Morrison family also owns and operates Morrison's Feed Bag retail store in St Johnsbury, VT.

Since Morrison's Custom Feeds is a major player in the local organic feed industry, they were looking for ways to bring more local, clean electricity onto the grid and reduce their operating costs to keep their products affordable for years to come.

The Morrisons purchased a four-acre field one mile from their Barnet mill that had not been viable for other uses. However, discussions with Norwich Solar identified this as a potential site for a 500 kW AC ground mounted solar array--large enough to produce about the same amount of electricity as consumed at the Barnet mill & office. The Morrisons worked with Norwich Solar to design, permit, engineer, and construct their first solar project in 2020.

"This was my second opportunity to work with the Morrisons, a great Vermont

The four-acre field with a 500kW solar array, located one mile from their Barnet mill now joins Morrison's Feed total solar at the feed store in St. Johnsbury, Vermont. (Images: Norwich Solar).



Earl Morrison, Plant Manager, monitors the solar array production from his phone and states that "the site has been up and running for about 12 months now and we are very happy with Norwich Solar's help throughout the whole process."

Ajah Tier is Norwich Solar's Marketing Coordinator (tier@norwichsolar.com).

family agricultural company," says Norwich Solar staff engineer Nathan Billings "Their commitment to renewables and their community align perfectly with our missions of bringing local power, local products, and local jobs to Vermont."

To help fund the projects, Morrison's Custom Feed was able to win a REAP grant from USDA, while also taking advantage of state and federal investment tax credits.



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Installing a Solar PV Upgrade During the Winter

Barb and Greg Whitchurch

We've been trying to electrify our lives for some time now, mainly in an effort to help preserve some remnants of our environmental status quo: the air we breathe and the climate we depend upon. But also, to preserve our own personal health and comfort and the affordability of our lifestyle.

We installed about 4kW of rooftop solar PV with battery back-up in 2010, then built a Passive House addition to our house for Greg's parents in 2014 and installed another 3kW in 2016 to "net-zero" that. Then we replaced our gas- mobiles with EVs and are again spending about \$2,000 a year on electricity --- but \$0 for gasoline for lawn, garden, logging, and driving.

So, we added another 10kW this January for a total of 16.7kW AC. We're planning to replace our electric water heater with a heat pump, to be driving more after COVID, and, as we age, to replace our wood stoves with heat pumps. Being retired and on fixed incomes, we now hope we've ended our utility bills forever.

We'd been researching vendors for two years. We ruled out trackers because of their maintenance and failure records versus the relatively small contribution made by the tracking itself, and a few extra panels, which are very cheap now, will make up the difference.

We skipped through a bunch of providers who seemed to be looking for the low-hanging fruit of people who aren't interested in details and system comparisons; who are basically willing to just write a check to the lowest bidder. We did look carefully at options and features; final cost per watt was not at the top of our list. Reputation, experience and patience were more important to us.

Natosi Solar (natosisolar.com) did not try to fast-talk or pressure us, or have set offerings or a limited product selection. They were open to new strategies and didn't pretend that direction, angles and snow "don't matter that much," claims which

sloppy installers often make. They also do large commercial projects and were endlessly patient during the planning stages.

Our location calls for a tall and wide array that would fit into a corner of the woods behind our house. We wanted the process to be as "green" as possible, so no concrete. Greg talked to Zach LaPorte at

Techno Metal Posts (bit.ly/vt-helical), and he engineered a beautiful design with a large screw pile and outrigger braces underground. However, we wanted to put up a very large single-pole array so as to avoid multiple foundations, and the weight and wind load metrics ruled out the helical pile. (But they work wonderfully in most PV applications, thereby eliminating the most climate-damaging material used in construction: concrete.)

Concrete is back in the picture - yuk. We measured distances and drops in elevation from the neighbor's driveway to see if we could avoid a pumper by sluicing the stuff down a chute; but no - yuk, again. But at least we have only one pole. Natosi chose a 10-inch-by-17-foot schedule 80 (VERY heavy-duty) pole and a 3-foot-by-8 foot Sonotube. Greg talked to area concrete providers, and we ordered 20% fly ash (low-cement) "green-ish" concrete which takes a while longer to set but is actually stronger in the end (see bit.ly/gerg-concrete).

Greg had been researching tiltable arrays for some time, but when Natosi joined in the search they discovered MT Solar (MTSolar.us). They also found a sale on 440W bifacial panels that cost almost the same as the 380W panels we'd initially chosen. So Natosi ordered the MT Solar "extra heavy duty" Top-15-Tall mount and its rail kit.

This MT Solar mounting is tiltable, allowing one to easily and quickly adjust the seasonal angle as often as one wishes (at each equinox is most common) to take advantage of the sun's angle of elevation as it changes during the year. It also allows

for all of the assembly to be done at waist height! No need to balance on step ladders, moving them constantly, stretching precariously to reach stuff. The whole thing can easily be moved up or down during assembly of the array. Then, when all the detail work is done, the array is hoisted up and fastened permanently at the top of the pole in just a few minutes. This is faster, safer and encourages more careful workmanship.

Gas-mobile trucks and excavation equipment are huge contributors to climate change, so we avoided idling at the site, and we chose the shortest route to the house for the underground cable. (We looked into an overhead drop for the wiring to save digging and conduit, but it didn't work out.)

The path toward "greenness" is a minefield of pollution compromises. (Think hybrid cars!) The sustainability contributions of your pro-environment efforts can be set back years by the choices you make on the path toward your goal. Many providers do not seem to care one whit about unnecessary pollution during their work. It's up to the homeowner to ask for these sorts of considerations.

Metal piles, poles, racking, wiring, conduit and PV modules

Cont'd on p.10

Many thanks to our sponsor:



Andrew Hammer, owner of Natosi Solar, hoists up the finished array.



Adam, the electrician, sits on an I-beam to make the final connections. Note adjusting screw above and to the right of the pole.

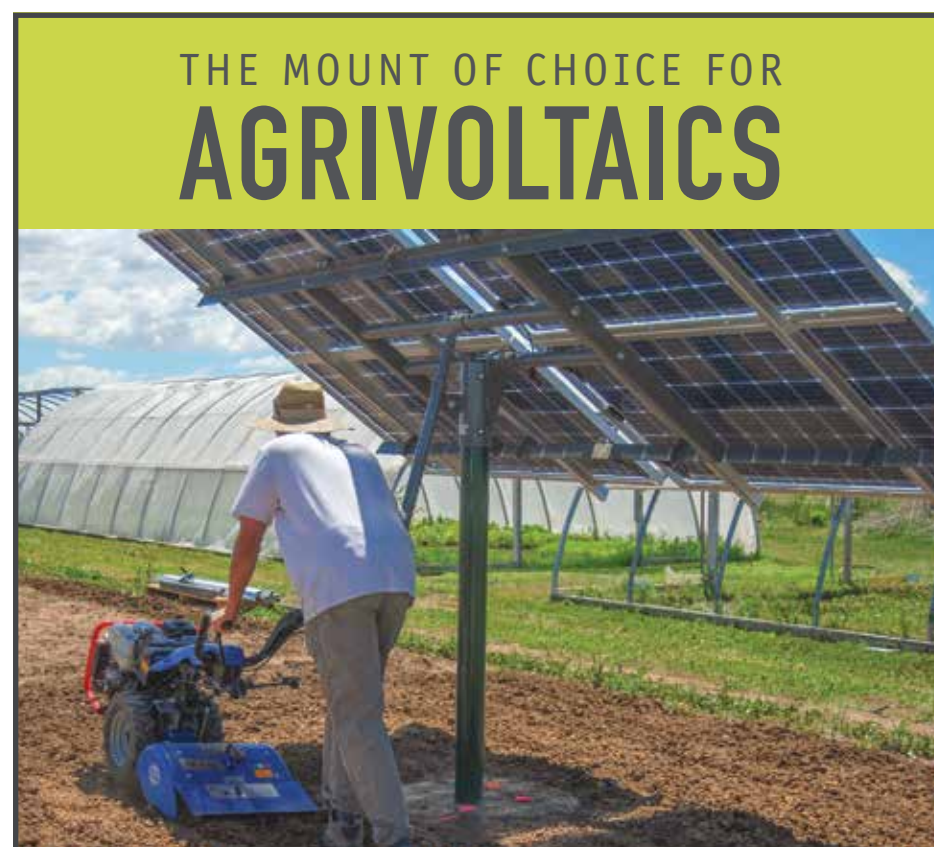


Barb and Remi (Saint Bernard) pose in front of the pole-mounted array, tilted for deep winter. (Images: Whitchurch)



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Winter Solar Upgrade – Cont'd from p.9

The new finished array is to the left of the Passive House cottage. Note more PV located at the right, on the main house, is not all visible.


are recyclable, unlike concrete and fossil fuel emissions. But even when separated and deposited correctly, only some of our recycling actually gets recycled. And the processes required to collect, transport and recycle those materials have their own very substantial environmental insults.

As is their custom, Natosi smoothed out their tracks, placed netting on the slopes, and reseeded everything through a blanket of hay. They hid most of the conduit and made everything that shows neat and attractive. They were most courteous, careful (all vaccinated and wearing masks inside), and open to suggestions.

Don't get too stuck on return on investment and payback period. The sooner you do it - with the higher Federal Tax Credit - and the more PV you put up, the sooner it'll "pay off" -- but also the sooner you can feel more free to continue electrifying your life.

We bought a 16-foot Garant plastic roof snow rake locally and the 22-foot version of the bit.ly/snopro2, which works great! In the deep winter position, snow seldom settles on the panel, but if it does, a whack on the lower I-beam with a two by four produces a cascading snowfall.

Now we have a nice new lawn ornament. A kind of high-tech sunflower that will generate clean energy for many decades to come, once it overcomes the embodied pollution and carbon costs of its manufacture, transportation and installation. Oh, well.

For many years, the Whitchurches have been gradually working toward electrification. They are owners of LEAF and Niro EVs, a net-zero Passive House in Middlesex, Vermont (bit.do/phc-vtbiz2) and are board members of VT Passive House bit.do/mdx-mec-bldg, bit.do/gkw-li. 

GMP is Building MICROGRIDS

George Harvey

Electric utilities face a special problem in a world is constantly changing. To function best, they don't just have to respond properly to changes that happen, they have to anticipate and be properly prepared for them. As part of that work, they periodically produce Integrated Resource Plans (IRPs) detailing what they are preparing to do for the future.

Green Mountain Power (GMP) files an IRP every third year with the Vermont Public Utilities Commission. The most recent was filed in late 2021 (www.bit.ly/GMP-IRP-2021). The plan provides details on how GMP expects to address climate change, increase reliability and resiliency, and provide its customers with cost-effective carbon-free, renewable power. Part of the plan shows that GMP will increase the numbers of microgrids in the state. It will also build up a two-way sharing system, generate more renewable electricity closer to where it is used, and increase the electric vehicle charging system.

A microgrid can continue to operate when the broader grid fails. It does this by including the generating and electric storage capacities along with the loads they will provide for, along with the electronics needed to "island" it, detaching it from the rest of the grid. In theory, a microgrid could operate entirely in the absence of the broader grid for an indefinite time, though there are benefits for both when they operate together.

Microgrids are not new. They have been around for a long time. In the past, they were often built around

Cont'd on p.14

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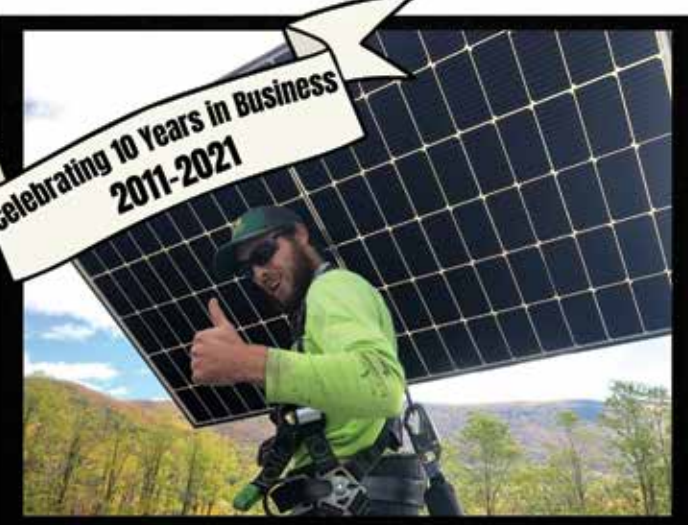
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A Community Strives for Energy Sovereignty

Pamela Worth

In the early 20th century, Ford Motor Company opened the world's first moving assembly line in Highland Park, Michigan. The auto industry fueled the city's economy for generations, transforming a rural town into a busy city. However, when the auto industry took hits, so did Highland Park. Today, the city's roughly 10,000 residents—of whom about 46% live at or below the poverty line—are interested in a more collaborative model of innovation and grassroots transformation: building resilience within their community through “energy sovereignty.”

“The traditional model of communities paying utility companies for power and people not having much of a say in it isn't working for us,” says Shimekia Nichols, executive director of the Highland Park-based nonprofit Souldarity. “Like residents in many communities, Highland Parkers want the ability to choose clean, locally generated power and keep more of the money we spend for electricity circulating in our neighborhoods.”

Souldarity and the Union of Concerned Scientists (UCS) set out to explore how Highland Park might realize its vision of a locally controlled, equitable, and clean energy system—a system powered by resilient and affordable resources like solar and energy efficiency, owned by residents and businesses.

A MODEL FOR MANY COMMUNITIES

Souldarity was founded ten years ago after the local electrical utility serving southeast Michigan, DTE Energy, didn't just turn off but removed more than two-thirds of the community's streetlights as it strug-

gled to pay high electricity bills. Since then, Souldarity has worked to install solar-powered streetlights, help residents improve energy efficiency in their homes, and advocate for a just and equitable energy system. In conversations with UCS Campaign Coordinator Camilo Esquivia-Zapata, Senior Bilingual Energy Analyst Paula García, Senior Midwest Energy Analyst James Gignac, and Energy Organizing Manager Edyta Sitko, Souldarity members and city residents turned to Souldarity's *Blueprint for Energy Democracy*, and a previous UCS analysis conducted in partnership with a Boston neighborhood, to begin charting Highland Park's path toward energy sovereignty.

“We wanted to map out what a local future of clean energy could look like for Highland Park,” says Gracie Wooten, a Highland Park and Souldarity member. “Our vision is strong, but we wanted data and modeling to back up our case to residents, officials, and utilities that the vision is real and achievable.”

Using information provided by Souldarity's experts and through other research—and applying modeling software called Hybrid Optimization of Multiple Energy Resources (HOMER)—Gignac, Sitko, UCS Energy Modeler Youngsun Baek, and the rest of the team created a comprehensive



Trainers and attendees carry a solar panel during a rooftop solar training in Highland Park, MI. Below: At a solar training at Parker Village in May 2021, Highland Park residents learn about how rooftop solar projects connect to a home's electricity meter. (Images: Nick Hagen)



analysis that shows how energy efficiency and clean energy generated locally by rooftop solar panels installed on homes and businesses, larger solar installations, and a community water and energy resource center to process wastewater and turn it into electricity could meet 100 % of Highland Park's electricity demand. The full analysis, presented in the report *Let Communities Choose: Clean Energy Sovereignty in Highland Park, Michigan*, can be found at www.ucsusa.org/resources/let-communities-choose-clean-energy.

Sitko says Souldarity is running with the results. “They've been engaged in conversations with city officials around their

goals,” she says. “And using the analysis as a pressure point for that. We wanted to help continue and contribute to the great work they're doing.”

REDUCING POLLUTION, IMPROVING SERVICE, AND LOWERING COSTS

As the recent UCS report *A Transformative Climate Action Framework* makes clear, we cannot achieve the clean energy transition we so desperately need without accounting for the needs of all kinds of communities in the United States. For example, because of systemic racism, fossil fuel generators that burn coal and gas are disproportionately sited in or near low-income communities and communities of color, contaminating the local environment and posing health risks for residents. Shifting to clean energy would not only drive down carbon emissions but also right this injustice.

In Highland Park, which University of Michigan researchers have identified as particularly vulnerable to air pollution from nearby power plants and factories, residents are paying the price—and not just in negative health outcomes. According to well-established economic research, energy costs should make up six percent or less of a household's income. But in Michigan, households with annual incomes similar to Highland Park's median income pay 18 to 33 percent of their incomes, according to Souldarity calculations. This inequity is partly driven by aggressive increases in DTE Energy's residential electricity rates. In addition, some Highland Parkers have reported multiple days of outages over the past year.

“It's not hard to understand why cities like Highland Park would demand safe, resilient, clean, affordable, and community-driven systems,” Gignac says. “Energy sovereignty should be a core building block as we seek not only to decarbonize our power generation, but also to address the ways in which electricity production and distribution are unjust and inequitable.”

“This is some of the most meaningful work I've done with UCS,” says Sitko. “To make this point and prove that locally produced and owned clean energy is possible for communities like Highland Park. Now let's make these changes happen.”

Pamela Worth is senior writer in the Communications department at the Union of Concerned Scientists.

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GREEN POWER SERIES: SOLAR FARMS IN THE NORTHEAST

Part 3: Bolstering Economic CSF Investment for New Hampshire

Toby Martin

In January 2022, four years after its municipal solar project had begun developing preliminary plans, New Hampshire's City of Manchester announced that the new array was online and fully operational.

According to a press release from mayor Joyce Craig's office, it will generate 3.8 million kilowatt hours of zero-emission energy per year, offsetting the equivalent of more than 2,700 metric tons of CO2 emissions as well as associated toxic gases and harmful airborne particulates per year that would have been produced if it were a generating plant burning three million pounds of coal. This is the largest municipal project in New Hampshire.



Shown l to r: Sam Feigenbaum and Tom Holt of Kearsarge Energy, Nils Behn from Aegis Renewable Energy, and U.S. Secretary of Energy Jennifer Granholm at the Manchester, NH Community solar site on Sept. 10, 2021 prior to the start of construction.

In September 2021 U.S. Secretary of Energy Jennifer M. Granholm visited the site, and praised the city's decision to locate the 8,000-panel ground-mounted system, which occupies the city's former decommissioned 12-acre landfill and will be able to supply electricity for approximately 350 New Hampshire homes. It is estimated that Manchester will receive energy savings and tax revenue of more than \$500,000 over 20 years at no cost to the city.

Manchester's Deputy Public Works Director Tim Clougherty stressed the city's dedication and commitment to clean, sustainable energy practices when he affirmed, "When coupled with energy efficiency initiatives, Energy Star compliance, and participating in the EPA Better Buildings Challenge, this project represents the latest example of the City's forward-thinking regarding conservation."

In addition to the Manchester Department of Public Works, there were several key partners in this

project. Engineering, procurement and construction was managed by Aegis Renewable Energy. Kearsarge Energy was the finance and holding company. Kingsbury Companies, LLC was the civil site contractor.

Nils Behn, CEO of Aegis Renewable Energy, explained the mission-driven enthusiasm the company has had for the project, "We love constructing solar projects on landfills. Now that the landfill has been closed, we can shift our use from what could be seen as an example of humanity's harmful impact on the planet to a use that brings us all one step closer to living sustainably. We are proud to be a part of that absolutely necessary transition."

Other clean energy investments made by Manchester of the past years include adding energy-efficient buses to the transit authority fleet which cut emissions from diesel buses by 96%. The City also converted city lights to LED eliminating the emissions of 2,000 tons of carbon dioxide.

Cont'd on p.13



Manchester, NH landfill solar array in Nov. 2021. The project consists of more than 8,000 solar panels. (Images: Aegis Renewable Energy)

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ENERGY

Manchester, NH is Second City in the Nation to Use 100% Recyclable Carts

On January 19, Mayor Joyce Craig and the Department of Public Works announced the City of Manchester has partnered with Rehrg Pacific to roll out new recycling carts made from ocean-bound recycled plastic.

Manchester is only the second city in the nation to utilize ocean-bound recycled plastic in their recycling carts. The OceanCore carts will replace broken or new carts for Manchester residents across the city.


The OceanCore cart is made from a blend of 40% post-consumer recycled material,

10% of which is recycled ocean-bound plastic found in and near lakes, beaches, and waterways on the way to the ocean.

"We're thrilled to be the second city in the nation to partner with Rehrg Pacific in using their 100% recyclable cart," said Mayor Joyce Craig. "Distributing recycling carts composed of reusable ocean-bound plastics is another way the City of Manchester is working to ensure our community remains healthy and sustainable for future generations."


"We are undoubtedly excited to be taking another step into sustainability by issuing Rehrg Pacific's OceanCore carts for our curbside collection," stated Chaz Newton, Solid Waste and Environmental Programs Manager, Department of Public Works.

Cont'd on p.13



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GREEN POWER SERIES – *Cont'd from p.12*

Cipriani Energy Group is an affiliate of the Sol Real Group which began in Italy, expanded into Eastern Europe, Central and South America, and now is in the United States. Cipriani's American base of operations is in Colonie, New York.

Cipriani's first three community solar farms (CSFs) in upstate New York are being built in Champlain, Cortlandville, and Johnstown/Mohawk, which when completed will produce enough electricity for approximately 1000 households (9.7 MW). The company reports a total of 15 community solar projects in the pipeline.

Per Laura Faust, Office Manager at Cipriani Energy, it takes about five acres of land to hold a MW's worth of solar panels. The company is talking to local farmers about grazing sheep rather than mowing. They're considering farming alpacas at some locations. They are also partnering with beekeepers to have beehives on the land which will be seeded with native wildflowers. They've even applied for a trademark for their Sunny Hunny.

Chris Stroud, Chief Operations Officer at Cipriani Energy explained some of the complexities of building a community solar project. If upgrades to the power lines or substations are required for the CSF, the developer pays those costs, not the utility company. Even with such costs, CSF subscribers can expect to save 10% on their electric bills.

New York's Legislature exempted solar panels from local property taxes to encourage the industry, but this means that the local communities do not bring in as much tax revenue as they might otherwise with a CSF compared to other types of development. But New York state also allows local governments (county, town, school boards) to each negotiate PILOT (payments in lieu of taxes) fees from the developer to compensate for this loss of tax revenue. The developer pays the PILOT to the local governments for up to

15 years. Since the PILOT fees are stable over the long term, Stroud said his company prefers it to potentially unpredictable taxes.

Stroud stated that solar development is a good neighbor. It does not require additional infrastructure like water or sewer, so it is not a drain on a town's resources, nor is a CSF a source of air or water pollution. The working life of solar equipment is 25-35 years, at which point Cipriani Energy plans to recycle or re-use as much of the equipment as possible to reduce the environmental impact. If the electricity from the solar farm is no longer needed, the land can easily go back to what it was before.

Eden Renewables, based in Troy, New York, wants its solar development process to also enhance biodiversity, support local agriculture, and provide educational benefits to the communities where their eight solar farms will be built—the towns of Claverack, Glen, Schaghticoke and Schodack, all located in the Capital Region. The company began in 2013 as UK company Solstice Renewables and became Eden Renewables in 2017.

Eden broke ground on its first CSF, the Elmbrook CSF in Schodack, NY in September 2021. Each of the eight projects will have an installed capacity of 7.5 MW, totaling 60 MW, which they estimate is enough to power around 9,800 homes. Subscribers can expect to save about 10% on their annual electricity costs.

The company values community engagement. According to Jonaliza Ceklic, Community Affairs Manager at Eden, each solar farm project will give \$3,000 in educational support per year to schools of CSF host communities: \$2,000 towards facilitating and delivering workshops, field trips and other Green S.T.E.A.M. activities (Science, Technology, Engineering, Arts and Mathematics related to the environment and sustainability), and \$1,000 toward scholarships. In 2021, the education support program awarded \$17,000 in scholarships.



The 7.5MW Elmbrook community solar farm in Schodack, NY is large enough to power 1,225 homes. (Image: Eden Renewables)

Eden Renewables' Chief Development Officer, Giovanni Maruca said, "The Eden Education Program ensures that young people who will be most directly affected by the future impacts of climate change receive support, enabling them to be part of the solution. Through our Green STEAM Scholarship, Eden aims to increase the environmental workforce to meet the growing demand for green careers as the U.S. transitions to a clean energy economy."

Plans are in place to make good use of the roughly 35 acres of land at each CSF site. The company will plant native wildflowers, grasses and hedges as ground cover under and around the solar panels. The company intends to have sheep graze around the panels.

"We are also looking to add community gardens at a few sites. We look to the host communities to see what their needs are and try to work those into our developments," Ceklic said.

Maruca adds, "Eden's community solar

farms are a great example of how land can be used for multiple purposes...Soon there should be butterflies fluttering, birds singing and bees buzzing around newly planted photovoltaic panels, helping local people to save money on their energy bills."

G.E.T. readers should note that in June, 2021, New York's legislature passed a law allowing for cross utility crediting. That means that a customer in one utility coverage area can subscribe to a CSF in another utility territory. That opens up CSF benefits to customers in underserved areas.

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 the G.E.T. as a writer and member of its Maine distribution team. ♻️



A three megawatt, 16-acre solar project in Cortlandville, NY on Tower Road can provide power to up to 300 homes. (Image: Cipriani Energy)

Manchester City Carts – *Cont'd from p.12*

"Partnering with Rehrig Pacific on their OceanCore cart signifies the commitment that the City possesses to achieve our waste goals."

Using OceanCore carts is one of many ways the City is continuing to invest in environmentally-friendly practices and has made significant progress in recent years.

This includes the City's recent sale of \$46.5 million in green bonds, which will finance a portion of the City's program to remove combined sewer overflows into the Merrimack River, resulting in cleaner water. These green bonds must be used to finance projects that have a positive environmental impact.



The OceanCore carts for Manchester residents across the city. (Rehrig Pacific Company)

In addition, The City recently finalized construction of a solar array on the former landfill. This project is now the largest municipal solar array in the state with more than 8,000 panels that will supply approximately 3.8 million kilowatt-hours of clean energy to the power grid on an annual basis (see article on page 11 of this issue of G.E.T.)


Over the past few years, the City has also added energy-efficient buses to the Manchester Transit Authority fleet, cutting emissions from diesel buses by 96%, and converting city lights to LEDs, thereby reducing the city budget and eliminating 2,000 tons of CO2 emissions. ♻️

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Maine Businesses Launch PATHWAY TO CLEAN ENERGY

How about committing your business to 100% clean energy?

With the climate crisis in full swing, a group of Maine businesses has launched a project called "On the Pathway to 100% Clean Energy." ReVision Energy is helping get it kickstarted as a member of the "Leadership Circle" with ReVision's co-owner Joel Alder on its advisory board. The overall message of the program is that every business can get on the pathway to 100% clean energy and decrease reliance on fossil fuels. Through simple, concrete steps such as weatherization, electrification, and solarizing, companies can start planning now for a clean energy future.

"You can start small," explained Alder, "but the idea is that you get it started and build on it and keep going. Businesses can get on the right track now and think about it on a regular basis; the idea is that you don't keep putting clean energy on the back burner."

The project is simple to join via three steps:

1. Sign a letter committing your business to the goal of 100% clean energy.
2. Share your "first meaningful milestone." Write down what you have done (or are about to do) to reduce fossil fuels and begin your journey to 100% clean energy.
3. Outline a plan to eliminate all of your remaining emissions, over time.

There is no time limit, and no cost to join 'On the Pathway to 100% Clean Energy.' The website has a number of tools to help businesses with their planning, including an emissions calculator and various guidebooks. Once a business takes the pledge, they will receive recognition



on the website and through the campaign's publicity efforts.

"It's a booster for companies who are on the campaign," Alder explained. "Their customers will appreciate it, and it will bring them new attention from other climate-conscious consumers."

The project is independent and non-political, and so far, it includes a dozen Maine businesses which have taken the pledge: Lamey-Wellehan Shoes, Scratch Baking Co., GWI, Geiger, FlowFold, LooHoo Wool Dryer Balls, ReVision Energy, Fiddlehead Designs Cabinetry, Wicked Joe Coffee, Wicked Leaf Tea, Green Clean Maine, and Spark Applied Efficiency. The Maine Climate Action Plan, developed in 2019, includes a call to the private sector to help fight the climate crisis through partnerships and leadership. As more businesses sign on, there will be ample opportunity to share best practices and gain from the experience of other businesses.

"One of the major goals of the project is to show that we have the potential to stop fossil fuel emissions from thousands of Maine businesses," said Jim Wellehan, CEO of Lamey-Wellehan and also an 'On the Pathway to 100% Clean Energy' advisory board member. "Once a business's owners have made the commitment, it may mean taking small steps in the first year, then ramping up, year after year. But that's what it means to be 'On the Pathway to 100% Clean Energy.'"

To learn more and take the pledge to 100% Clean Energy, check out the website: www.bit.ly/Pathway-to-CE.

MICROGRIDS

Cont'd from p.10

diesel generators that could start up in the event of grid failure, keeping disturbances down to a minimum. Hospitals often operate this way.

Modern microgrids are usually built around renewable energy resources. They are often designed so as to provide power for such things as emergency shelters in a community, along with fire stations, pharmacies, and food stores in their loads. The generating capacity is specified so as to be sufficient for the load nearly all the time, though many microgrids have additional backup capacity such as diesel engines.

GMP's IRP describes a move toward distributed generation in microgrids that will be undertaken in "hyper local planning." This will use technological innovations to "drastically improve" local resiliency by use of the microgrids. And with sufficient resiliency, a community can continue to function separately, when that is necessary.

GMP will begin by building a small group of the microgrids. One microgrid, in Panton, VT was commissioned in October of 2021 and already serves 51 customers. Its electricity is generated in an one megawatt (MW) solar array backed up by four megawatt hours (MWh) of battery storage.

Rochester is to have a microgrid in an area along Route 100. The area includes the town water pumps and an emergency shelter at an elementary school.

In Strafford, a microgrid will be in the



Solar array in Manchester, VT. (MarkBuckawicki, www.bit.ly/3GBpmMM)

downtown area. It will serve emergency shelters at the Newton School, Rosa Gym, and Barrett Hall, in addition to the general store and post office. It will get power from a solar project owned by the town and a 7-MW solar installation at the former Elizabeth Mine superfund site.

Two other microgrid sites are smaller. One is in a small part of Grafton, which will have solar power and storage integrated with the larger grid, but to continue operations when the larger grid is down. The other one is a cooperative housing community in Brattleboro that is vulnerable to flooding.

Along with these, there will be two other communities chosen for microgrids, though the decision as to which they will be has not yet been announced.

The microgrids being established by GMP are first steps toward a more distributed and resilient future. In it, local demand will be met, as much as possible, by local supply. And this implies local jobs and a more robust local economy in Vermont. ☼



South Portland's one-megawatt solar array at the City's capped landfill (929 Highland Avenue) came online in October 2017. ReVision Energy installed the 2,944 photovoltaic panels on the 34-acre former landfill, which is behind the City's transfer station and new public services facility. (ReVision Energy).

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Power Systems Float

J. D. Kaplan

The age of green energy and sustainable human life will require a leap of faith from us. So, as a counterweight to the difficulties of global cooperation, I'd like to offer G.E.T. readers a high-altitude snapshot of two bright areas of progress. Both are relevant for the central aim of decarbonization, but for different reasons.

I. SUBMERGED TURBINES

Much of the world's hydroelectric power is generated at plants where the water is blocked up. Earth-minded media (e.g., Patagonia, Terra Mater via undecidedmf YouTube channels) report a resistance against modern dams among the eco-friendly. Tens of thousands of dams exist around the globe, and the pattern of deployment has matured to reflect the concerns, but it continues. My sense is that people are tired of seeing dams built even if the carbon balance doesn't turn out detrimental.

If NASA can make errors in space navigation owing to unit conversion failures, math mistakes can plague ecologists. It is carbon accounting we're contemplating, which is a certifiable mess right now. Thus, zooming out a level will help. Technologies that require the practice of massively changing Earth's landscape should really take a back seat to means that don't. If we see progress among submerged power generators in the coming years, this option is within sight.

There is a tidal lagoon system proposed for Swansea Bay in Wales. It will be capable of generating 320MW at maximum production. This is a 'pathfinder' project, and there are several other ambitious tidal systems imagined by the same group (https://bit.ly/SwanseaBay_Tidallagoonpower).

I suggest viewing the Undecided channel with Matt Ferrell on YouTube for



Evopod tidal generator, fully installed. The rushing water provides power. (Ocean Flow Energy Ltd)

his reportage on tidal power and for his other energy-related entries (https://bit.ly/undecidedmf_tidalpower-explained).

The Patagonia channel has some quality work as well, including full-length documentary films relating to these topics. Their recent book, *Waves and Beaches* by authors Bascom and McCoy is top notch publishing.

II. THE 800-FOOT POWER PLANT

I live in a windy place. This audible arm of Mother Nature has drawn my attention for all the years that have elapsed since I landed here at the coast of Massachusetts. As a participant in the massive deployment of wind power generation, we're a spectacle of anchor dragging.

Cape Wind offers a wonderfully frustrating case study in sustainability progress. Such a simple step forward as to plant some windmills halfway out to sea to augment our electric grid blossomed into a contentious fight, putting property rights up there with actual impacts (e.g., bats, lobster meat). Eventually, everyone agreed to move on. The Cape Wind project effort collapsed

only 17 years after proposal.

It is now succeeded by several, including one called Mayflower Wind, which will be farther offshore and will use bigger turbines. The total generation capacity is much greater. I presume the same for the paperwork (https://bit.ly/boem_MA_RenewableEnergyProjects and https://bit.ly/boem_MA_WindProjects).

Problems of scale would always hold down the deployment of a big gen-

erator, but some peculiar ones keep offshore windmills off the investment slate. The installation of utility scale windmills has, to this point, depended upon special hardware, including ships dedicated to the task. (If you are incredulous, search for turbine installation vessel.) The cutting edge General Electric nacelles that claim to lead the industry in capacity factor—being as green as advertised—stand on 500-foot towers, for example. Bringing this out to a construction site several miles into the ocean is a very special task, indeed (<https://invent.ge/3620NMG>).

Planting this monstrous metal giraffe to the sea floor isn't easy, either. In fact, this leads to a core limitation of offshore wind power development: it must be grounded in shallow sea. Without a nice,

long, relatively flat sea bed extending miles from the coast, there is no place for permanent installations of any kind. Bathymetry presents this as a major regional constraint. The New England coastline has a good shelf before dropping off into an unbuildable abyss, but many do not.

The active projects succeeding the for-gone Cape Wind dream will ensure that we shall have our supersized windmills after all. The excruciating pace of this progress is ugly, but only reveals part of our problem. To deploy renewables en masse across our entire civilization, engineered solutions to surmount limitations put in place by nature are just as important as meeting funding, finance, and bureaucratic challenges. The administrative goal of 30GW of generation capacity offshore may well be met within the Biden Administration's ten-year time frame, but this is a very small, specific set of plans within the grand scope of global power generation.

J. D. Kaplan is a certified remote pilot and a former member of the I.T. crowd. He is a reader in the areas of bioelectromagnetics and cryptocurrency. Mr. Kaplan plans to profile blockchain & crypto-mining activity around the energy sector. He lives and works at or above sea level near Boston, MA. ♻️



Tidal Energy Ltd, DeltaStream installation in Ramsey Sound, Pembrokeshire 2015. (Wikimedia/RebeccaLouiseJones)

Renewable Energy Can Drive Healthcare Costs Down

George Harvey

Concerns about the health issues relating to the use of fossil fuels have been around for years. Nevertheless, many people do not know how bad things can get – or are.

In October 2016, the American Lung Association in California (ALAiC) published a paper, "Clean Air Future: Health and Climate Benefits of Zero Emission Vehicles." It addressed the health issues of air pollution arising from the use of vehicles powered by fossil fuels (www.bit.ly/35LButt). The paper looked at ten states that had specific laws promoting the use of electric vehicles (EVs). Two of these states are on the West Coast, but others included New York, Connecticut, Rhode Island, Massachusetts, Vermont, and Maine.

According to that paper, burning a gallon of gasoline in a car produces societal effects that come to \$1.30. About two-thirds of this is related to the cost of health effects. A simple way to look at this is that if you burn ten gallons of gasoline, you cost people \$8.67 in damage to their health, and about \$4.33 in other damages.

The ALAiC paper put the annual

societal cost of the use of fossil fuels in transportation in Vermont at \$313 million. This was about \$486 per person per year. It was covered mostly by insurance and taxes, so most people don't know about it. Nevertheless, for a family of five, the damage done by fossil fuels would have been upwards of \$2,400 per year.

Recently, we got more information in a somewhat different form. A team of researchers from Columbia and Duke Universities did a newer analysis that looked at the question to find out what we could save over time by switching away from polluting energy sources as quickly as possible. Their paper, "Temporal and spatial distribution of health, labor, and crop benefits of climate change mitigation in the United States," (C&D paper)



Medical tools include stethoscope and laptop. (National Cancer Institute, Unsplash. bit.ly/3l90nsy).

appeared in the journal *Proceedings of the National Academy of Sciences of the United States of America* (www.bit.ly/32rNLWN).

According to the C&D paper, if we were to stop emitting greenhouse gasses (GHGs) immediately,

the climate would still warm for some time because of the carbon dioxide already in the atmosphere, something many of us knew already. But the focus of the article is that the particulates, ozone, and other air-borne toxins would disappear almost as soon as the GHGs are eliminated, and the health effects of this would be almost immediate.

The health benefits of stopping the use of fossil fuels would very quickly mean saving thousands of people in this country from early deaths every year.

And, of course, it would correspond with a very large decrease in health costs for many thousands of people.

The research also touches on peripheral, but vital, areas. Worker productivity would increase, because people in better health work better. Also, the pollutants that affect human beings also affect animals and plants, so eliminating pollutants will increase the food production.

It is important to note that, if we eliminate fossil fuels, the benefits will come back to us locally, regardless of whether the rest of the world goes on polluting.

All told, the report concluded that the benefits of eliminating fossil fuels will provide health and other side benefits that are worth between five and twenty-five times the cost of switching to other sources of energy. That amount, please note, is in addition to the amount saved by reducing climate change.

To put specific values on it, the paper concludes that U.S. public health benefits during the remainder of this century arising out of eliminating fossil fuels quickly could be somewhere between \$56 trillion and \$163 trillion. ♻️

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 fpr.vermont.gov/woodenergy/rebates**

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

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

Other Utilities Heating Offers

- Members of Washington Electric Co-op (WEC) can get a \$1000 rebate on approved pellet boilers and \$500 for pellet furnaces. This can be combined with the CEDF and Efficiency Vermont incentives for a total of \$7000; \$250 for qualifying pellet or wood stove installed by a qualified installer. This can be added to stove offers from CEDF and Efficiency Vermont.
- Members of the Vermont Electric Co-op can get a \$150 credit on the purchase of an approved pellet stove: www.vec/energy-programs.
- Stowe Electric Customers can get a \$150 rebate with the purchase of a pellet stove.
- GMP rebates available through December 31, 2021

VT TAX CREDITS

- Vermont offers an investment tax credit for installations of renewable energy equipment on business properties and wood and pellet heaters with at least 75% efficiency. The credit is equal to 24% of the “Vermont property portion” of the federal business energy tax credit.
- More info on the 2021 IRS Tax form at <https://www.irs.gov/pub/irs-pdf/f3468.pdf>

Tier III programs

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

EFFICIENCY VERMONT

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

Lighting

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

Weatherization

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

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

Appliances (must be ENERGY STAR)

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

Heating/Cooling/Water Heating

- Central wood pellet boilers and furnaces: \$6,000 rebate (in partnership with CEDF)
- Advanced pellet or cord wood stove: \$200 discount at participating retailers for replacing an old stove.

Heat Pumps:

- Air-to-Water System: \$1,000/ton rebate
- Ducted Systems: \$1000-\$2000 discount at participating distributors
- Ductless Heating & Cooling System: \$350-\$450 discount at participating distributors
- Ground Source Heat Pumps: up to \$2,100/ton rebate
- Heat pump water heaters: \$300-\$600 discount at participating distributors;
- Moderate-income Vermonters are also eligible for bonus rebates up to \$500 for heat pumps and heat pump water heaters.

- Window air conditioners: \$100 for select ENERGY STAR Most Efficient models.
- Smart thermostats: up to \$100 back for select ENERGY STAR models.
- Electric utility rebates may also be available.

Other Opportunities to Save

- Home Energy Loan – finance up to \$20,000 in energy-related home improvements with interest rates starting at 0%. Restrictions apply.
- Additional incentives may be available through your local electric utility provider. Contact your utility for more information.

Incentives for Pro-environment Agriculture Behaviors

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

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

Vermont’s GMP Extends Rebates Through 2022

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

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

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

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

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

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

Many thanks to our sponsor:



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:

- \$.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:
 - \$.012/rated or modeled kBtu/yr for new solar thermal facilities fifteen collectors in size or fewer; \$.07/rated or modeled kBtu/yr for new solar thermal facilities greater than fifteen collectors in size;
 - Expansions to existing solar systems not eligible.

Contact: 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 Home Performance with ENERGY STAR

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

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

NH ENERGY STAR Homes

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

NHSaves Residential ENERGY STAR® certified Products Program

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

- Refrigerator/freezer recycling is available – unit must be in working condition (10 – 30

cubic feet in size), program includes free pickup and \$30 rebate. For program requirements and scheduling information go to www.NHSaves.com/recycle.

- Instant rebates available on select ENERGY STAR® certified LED light bulbs purchased through participating NH retailers (offers vary by retailer, see store associate for details) Visit: www.NHSaves.com/nh-rebates.

- Rebates are available to residential electric customers of the four NHSaves utilities.

NHSaves Online Store

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

- Visit www.NHSaves.com/lighting-catalog.

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

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

NHSaves: nhsaves.com

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

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

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

Other NH Electric Utility Programs

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

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

Business Programs

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

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

NH Weatherization Assistance Income-Eligible Programs

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

Visit www.bit.ly/GET-NH-4 for application criteria, FAQs and local program contacts.

Community Development Finance Authority (CDFA) Clean Energy Fund

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

to support energy efficiency and renewable energy projects.

Small Business Energy Audit Grants

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

Community Facilities Energy Assessment Grants

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

Find out more at: nhcdfa.org/energy.

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSEERDA

Welcome to the New York solar incentive and rebate information: 169 programs and incentives at: <http://dsireusa.org> (enter your zipcode).

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

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

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

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.

ADVANCE

D 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>)

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

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

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

MAINE

EFFICIENCY MAINE

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

Home Insulation: Efficiency Maine offers weatherization rebates up to \$9,600 for income-eligible homeowners and up to \$5,500 to other Mainers. See bit.ly/EffME_HomeInsulation. Residents can estimate home energy efficiency with the calculator at bit.ly/EffME_SavingsCalculator.

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

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

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

Electric Vehicles (EVs) and Charging: Efficiency Maine offers rebates for eligible battery EVs and plug-in hybrid EVs at participating Maine car dealers. Learn more at bit.ly/EffME_EV.

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

Electric Vehicles: Efficiency Maine offers instant rebates for eligible battery EVs (BEVs) and plug-in hybrid EVs (PHEVs) at 67 Maine car dealers. The standard rebate is \$2,000 for a BEV and \$1,000 for a PHEV. Higher rebates are available for low-income customers, governmental entities, and select nonprofits. For a limited time, Efficiency Maine offers a promotion for businesses with five or more vehicles registered in Maine, paying rebates of \$4,500 on a BEV or \$3,500 on a PHEV for the first 50 vehicles on a first-come, first-served basis. Maine businesses can also receive up to \$8,000 for the purchase of an all-electric commercial van for business use. See bit.ly/EffME_EV_Rebates.

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

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

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

Now's the Time for Clean Energy Skills and Green Jobs

Mike Bailey

Just as at the start of the dot-com era in the '90s, and Sutter's Mill over a century earlier, right now there is a unique opportunity to make a great deal of money while creating a big improvement in our future.

There is a world-wide shift away from fossil fuels happening right now, so SolarFest held an online workshop on January 15 with the Rupert Meeting House to explore the transition to green jobs. Moderated by Joanne Coons, adjunct professor at TEC-SMART, they heard from six people who have already found exciting and profitable career opportunities in the trillion-dollar clean energy field. The panelists described how they got the skills and the breaks needed in a wide cross-section of areas that make up the sustainable 21st century economy.

The session began with a recent study from New York State that shows the fields that are losing jobs, including gas stations and other carbon fuel businesses like oil and gas heating and automobile repair. Conversely, the employment sectors adding jobs include building design and residential and commercial weatherization, advanced heating, ventilating and air conditioning (HVAC), solar power and storage, electric vehicle charging, wind, hydrogen and biomass.

Right from the beginning it was clear that there is no one path to finding a new, rewarding and exciting career in these new fields. The speakers have come from incredibly diverse backgrounds; they studied electricity, English and engineering, worked in welding, carpentry and auto repair, are part of non-profit organizations or run their own businesses. With these varied paths to success, however, they are all curious and looking for new solutions, share a passion for exploring new challenges, and love the meaningful

work to make a better world. Most importantly, they all said 'yes' when opportunity approached them.

So, where are the opportunities, who can participate, how do I get started? Let's listen to the experts:

Matt Desmarais said "Governments across the U.S. and Canada are using heat pumps as a solution for climate change to reduce carbon emissions. As a result, there's a huge demand for heat pump installers, engineers, designer and drillers...high schoolers with minimal skills are looking at \$25 an hour with specialists getting \$125 dollars an hour."

Devon Karpak added, "Right now we're trying to retrain after first, second or third careers -- it might be college, it might be trade school, it might be an apprenticeship. All are valid and valuable pathways."

The field of electric vehicles includes cars, buses, motorcycles and more. As Josh Robin explained, "This is absolutely the best time to get into the EV field, and this is a massive field. From the infrastructure side, you're looking at electricians, engineers, and coding is huge; everything needs software. The absolute best advice

is to surround yourself with people that share your enthusiasm and have knowledge that can help you grow."

In the booming area of building science, Gwendolen St. Sauveur pointed out that, "Cities and states across the country are requiring all residential new construction to meet the DOE net zero energy program by 2030, so contractors need to be comfortable building energy efficient homes. My path has been very non-traditional, which gave me the skill set for the construction side, the architecture side, and the mechanical side. So, follow your interests, don't be cookie cutter."

"You know there's lots of different jobs in in the solar field -- an interesting and diverse industry where you don't need really any experience; they'll train you on the job," said Will White. "You can obviously take classes from organizations like SEI, but then it goes into other things like design, electrical, mechanical, engineering, sales, marketing, procurement, HR, business development, and land use. There's so much demand in the solar industry at this point it's really amazing. And a little tip for those of us in the northeast -- with

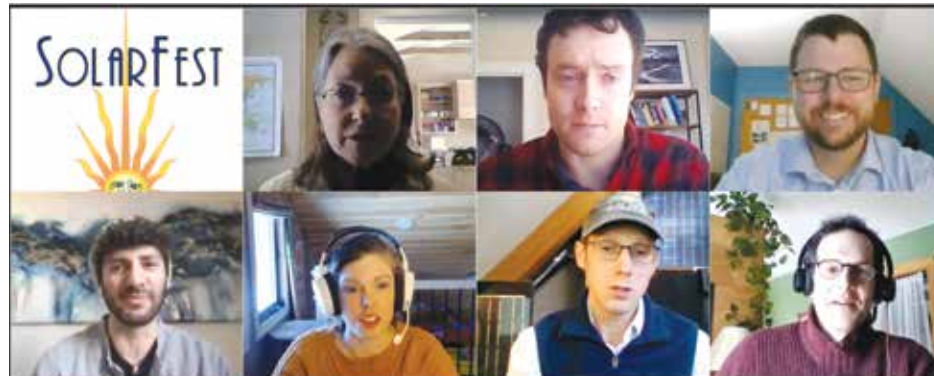
a New Hampshire electrical license you can get reciprocal licenses in many other states like Vermont and Massachusetts without having to take another test."

Tim Yandow reminded us about seeing the big picture. "All these great technologies, all these wonderful jobs that are out there...don't forget the fact that these are not necessarily as accessible to everybody. Through the weatherization assistance program, we make sure that people of lesser means are not left behind in the energy efficiency divide. If I could provide one little piece of advice: if you're interested in things then talk to the people who are already doing it, and who are passionate about it. Do things that are meaningful and interesting and purposeful to you. We have some big problems to solve and we need everybody to solve them."

Want to learn more? Watch the complete "Transition to a Green Job" workshop at www.SolarFest.org.

- Moderator – Joanne Coons; TEC-SMART Faculty at Hudson Valley Community College
- Matt Desmarais – Heat Pumps; Energy Catalyst
- Devon Karpak – Technology Education; Otter Valley Union HS
- Josh Robin – Electric Vehicles; Cornice Technology
- Gwen St.Sauveur – Building Design and Systems; BTF Residential Designs
- Will White – Solar and Storage; Solar Energy International (SEI)
- Tim Yandow – Energy Conservation and Weatherization; Efficiency VT

Mike Bailey, a Trustee of SolarFest, was formerly the Executive Director of Strategic Marketing Communications for NYU's School of Continuing and Professional Studies. ☼



Clean energy jobs panel (top row from left): Joanne Coons, Matt Desmarais, Devon Karpak; (bottom row from left): Josh Robin, Gwen St.Sauveur, Will White, and Tim Yandow. (Image: SolarFest)

FILABOT: CLOSING THE PLASTIC LOOP

Jessie Haas

Waste is only waste until the loop is closed. Then it becomes feedstock, and that's just what the Filabot company in Barre, VT, is helping make happen.

Filabot had its origin in 2011 when Tyler McNaney, then a freshman at Vermont Technical College, first learned about 3D printing. The process uses a machine to build things, from toys to machine parts to houses, by building up layers. A large portion of 3D printed objects are made of plastic, and plastic is a problem in the world. At least plastic waste is.

But McNaney was struck by a brilliant idea. What if he could invent a machine that would take waste plastic and turn it into the filament used by 3D printers? That could close the loop and turn garbage into feedstock.

From idea to company, the trip was short. Without so much as a prototype, he raised \$32,000 through a Kickstarter campaign, quit college, and within a year and a half had a machine that would grind up waste plastic into chips and extrude it into a filament. That filament was not quite ready for prime time; it tended to behave inconsistently. The filament needed to be chopped into small pellets, which go through a similar extrusion process to be turned into filament that can be used in a 3D printer. McNaney built 67 Filabot EX2 machines while keeping up with his studies at VTC but dropped out with one semester to go, in order to devote himself

fulltime to the company as it started to take off.

Growing up in Milton, VT, McNaney was a tinkerer from childhood, who describes hovering greedily while his father worked on repairing broken household items. If something wasn't repairable, it was fair game to be cannibalized for parts, and in doing so he and his brothers learned how machines work. They built racing lawn mowers and go carts, repaired computers and Segways, and amazed the neighbors with their inventions.

McNaney was also a Boy Scout, and his experiences camping inspired a love of nature and a 'leave no trace' ethic, that he brings to his business. The singular purpose of Filabot, what the team works on every day, is to recycle the widest range of plastic possible.

McNaney is actually a fan of plastic and acknowledges its positive, life-changing qualities. But plastic in the wrong place is pollution, and there is a lot of plastic in the wrong place on this planet. In his TEDx talk McNaney said, "After all this learning, it is a burden to know the full scope of the plastic issue." However, if the loop was closed, we wouldn't have a problem. He believes plastic, a symptom of materialism out of balance, will be one of the world's biggest issues over the next century.

Enter Filabot. It makes a machine that's been described as a sausage grinder on top of a spaghetti maker. It grinds plastic

into small pieces and pushes it into a melter. Then the plastic is extruded into different-sized filaments, air-cooled, and wound onto a spool.

Actually Filabot puts out many machines at this point, to handle all the stages of making filament for 3D printers. The first step in the process is the reclaimer, which grinds the plastic. Plastic is then dried, using an oven, dessiccants, or a standard polymer dryer. Next comes granular extrusion, through a Filabot EX2 or EX6. The first-stage filament is air-cooled, and then goes through a Filabot pelletizer, then heated and extruded again to become a spool of final filament ready to use for 3D printing. Filabot also sells a fume extractor to reduce customers' exposure to toxic chemicals.

One problem Filabot is able to solve is the high failure rate of 3D printing itself. It allows makers to grind up failed prints and use them again. It's also helpful in the recycling world. In a 2019 article in *The Montpelier Bridge*, McNaney noted



Above: the Filabot Air-path extrusion system makes filament for 3D printers. Right: waste plastic is chopped and placed in the hopper as raw material for extruded film. (Images: Filabot)



that contamination with black coffee lids, not generally recyclable, could reduce the price of a bale of plastic by 80%. Can these be fed into the hopper to become printer filament? Possibly. McNaney has expanded the range continually and is still working on a solution for PET, the material from which plastic soda bottles are made. Indications from

Cont'd on p.38

GLOBAL PROBLEMS (LIKE CLIMATE CHANGE) NEED GLOBAL SOLUTIONS

Bob and Suzannah Ciernia

The headline states the obvious but implementing policies to that end is not. While the goal of keeping climate change in check may be universal, every nation is competing with every other nation to provide its businesses and citizens an economic advantage. What's to be done?

Do we have any historical precedents that demonstrate the major economies can work together to address a common threat?

Short answer: yes. The Montreal Protocol on Substances that Deplete the Ozone Layer was ratified by all 198 members of the U.N. in 1987. Look back through the historical record and you'll see numerous articles in the 1970s and early 1980s on the threat posed by the loss of the Earth's ozone layer. Why aren't you reading such articles today? The answer is the world's peoples acknowledged the science and their governments agreed to the Montreal Protocol.

The ozone layer continues to be closely watched by scientists who predict that it will recover by the middle of this century. (www.bit.ly/About-the-Protocol) Significantly, the U.N. reports that, compared to 1990 levels, 98% of ozone depleting substances have been phased out of use.

What's the lesson for today's climate crisis? It is possible for competitors to recognize a common threat and to take collective action to mitigate it.

Climate Change poses a more complex, multi-faceted challenge

Addressing ozone was relatively straightforward. The number of chemicals involved was small, the number of businesses reliant on them limited, the threat was immediate, and substitute chemicals were both available



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Europe if the country of import does not have a carbon price equal to that charged in Europe. Businesses inside the E.U. are paying a tax on carbon already; the CBAM on imports is meant to level the playing field so that foreign competitors don't have an

advantage.

A simplified example. Before a CBAM: E.U. Steel Co. No. 1 pays a carbon tax of \$65 per unit and puts its product on the market at \$365. Foreign Steel Co. No. 1 doesn't pay a carbon tax so it offers its product at \$300. Most of us would conclude that Foreign Steel has a better shot at the contract.

After a CBAM: E.U. Steel still pays a carbon tax and still offers its product at \$365. Foreign Steel, on the other hand, because its country doesn't have a price on carbon, must pay the E.U. (the government, not the steel company) \$65; it now offers its product at \$365. Bottom line: the foreign company no longer has a competitive advantage. Environmental bottom line: because of its carbon pricing, the E.U. has a better chance of achieving its target of reducing emissions 55% by 2030. Governmental bottom line: the E.U. collects money it can use to fund additional carbon reducing programs.

The effect on U.S. businesses

In the scenario above, American companies shipping cement, fertilizer, iron and steel, and aluminum to the E.U. will be required to pay a CBAM because the U.S. does not have a price on carbon equal to the tax the E.U. puts on its own businesses. The relative advantage we have today will disappear once our businesses are paying the same tax Europeans already pay.

and cost-competitive.

Clearly, those statements do not readily transfer to the fossil fuels causing climate change. Economists can tell us that if you want to reduce the use of something, you need to put a price on it, and scientists can tell us (and have told us for decades) that climate change is a locomotive building up a head of steam that will be difficult to stop once fully in motion. But none of that has tipped public opinion to the point where we are willing to forego immediate comfort for a safe future.

Until now. Now, the science is evident in our day-to-day lives and an increasing number of people are saying, "Something needs to be done!"

But the people and businesses who profit from fossil fuels are not inclined to give up their source of income and the argument has often focused on "What about China?" and "What about (pick a country)?" The assumption here seems to be that we (the U.S.) were already the world leader and everyone else was trailing behind.

That's not the case.

The E.U. has implemented a CBAM and the U.S. has not

What is a Carbon Border Adjustment Mechanism (CBAM)? The E.U. will implement a policy in 2023 that will put a price (a tariff or levy) on certain products as they enter

Investing for Clean Energy Income

Todd M. Walker and Craig R. Walker

"OMG, where did my interest go?"

If that sounds like you recently as you looked at your bank, CD, money market, bond or fixed annuity account statements, you're hardly alone. Due to governments around the globe lowering interest rates in order to stimulate economies during Covid-19, interest payments are at all-time lows – in many cases barely above zero.

While this may be great for businesses and borrowers, for those who depend on regular interest income to maintain their lifestyle, it can be a real hardship. In fact, with inflation now on the rise such low-rate interest accounts can actually be losing you money. For example, if the annual inflation rate grows to 5% a year, by the time a two-year CD paying 0.50% annually matures, your money would be worth approximately 9.0% less in spending power. And who knows how long this might last with all the Covid variants out there? But there is one reliable, socially-responsible place you can turn today for higher income on your money.

Earn High Investment Income from Clean Energy Power Producers.

You're probably familiar with dividend-paying stocks – relied upon by income investors for decades -- but as a believer in clean energy you may have shied away from the kind of companies that traditionally pay larger dividends, such as big oil and pipelines, or fossil-fuel-burning utilities.

But there is a lesser-known market niche



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that actually pays high dividends you can believe in. It's the growing number of clean energy power producers – think of them as clean power utilities.

These companies own large installations of hydro, wind, utility-scale solar, distributed generation, battery storage and other renewable technologies that can generate annual dividends for shareholders of 3-5% or more.

Some good examples would be:

- **Brookfield Renewable Corp** (symbol BEPC) – current yield* 3.55%
- **Innergex Renewable Energy** (INGXF) – current yield* 4.10%

Plus, there are mutual funds and exchange traded funds such as **New Alternatives Fund** (NALFX) and **Global X Renewable Energy Producers** (RNRG) that specialize in this area.

Some Tips Before Proceeding

- Like all stocks and stock funds, dividend payers will rise and fall with the markets and past performance is no guarantee of

future results. Also, unlike bank accounts, they are not FDIC insured and their dividends can be reduced or suspended at any time by management.

- Like all stock investments, it's important to diversify your holdings among a portfolio of companies and types of securities, including bonds and bank/ insurance products, to help reduce risk over different market conditions.
- You can invest in dividend-paying stocks by opening an individual brokerage account with such firms as Fidelity Investments, Schwab, Interactive Brokers or many others, or if you do not have the time or experience, consider retaining a qualified Financial Advisor who specializes in socially responsible investing.

If you are producing your own power now, you know what a great feeling that is. Now enjoy the same feeling on your portfolio income! People today have to be more creative in the search for higher investment income, and what better for believers in renewable energy than higher investment income from reliable clean power producers.

* As of 1/18/2022

Todd and Craig Walker are Financial Advisors at Greenvest®, a Vermont-based personal asset management firm specializing in socially responsible investing since 2004 and a certified B Corporation®. www.greenvest.eco.

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GREEN ENERGY TIMES SOLAR INSTALLERS

We at *Green Energy Times* sent out a 2021 solar survey asking every solar installer or developer what they accomplished in the past year. These are businesses we know and would suggest you look into to see how they might be helpful for you and your particular circumstances. There have been other lists of top installers that you may have seen. Our goal was to let you know about the installers we feel are trustworthy in our region.

Our list is not rated. It is more about where they are and the things they do that would be most helpful to you. They are listed in alphabetical order. Our goal is to help you create a cleaner power supply for our energy grid that will not only help reduce emissions and save our planet in a time crisis, but more important, will help each of us reduce our cost of living.

Please note the following abbreviations: Engineering, Procurement, and Construction (EPC), kilowatt (kW), kilowatt-hour (kWh), megawatt (MW), megawatt-hour (MWh).

3rd ROC Solar – Pittsford, NY.

It has grown every year since it was founded, in 2017, and has installed 2 MW of systems altogether, including 980 kW in 2021. It does EPC and contractor work in New York. It can install off-grid systems and grid-tied systems with battery backup, in addition to conventional systems. It will provide service for existing systems and can monitor systems remotely. "We use Tier 1 panes, optimizing inverters and micro-inverters. We specialize in both roof mount and ground mount systems." The website is www.3rdROCsolar.com, and the email address to contact is sales@3rdROCsolar.com.

603 Solar – Exeter, NH.

It was founded in 2018 and has grown since then "through being honest, transparent, providing great customer service and giving people the best return on investment possible." 603 Solar serves New Hampshire and Maine, giving EPC and contractor services for both commercial and residential customers. It has installed 4.766 MW of solar systems since its inception, with 1.799 MW of that in 2021. It does not provide off-grid systems, but can install battery backup for grid-tied systems. "We just recently completed a 48.8 kW array on a brand-new NH State Liquor store in Concord, NH." The website is 603solar.com, and customers can email it at Zach@603solar.com.

Aegis Renewable Energy – Waitsfield, VT.

It started business "in 2011 as a commercial wind turbine installation and service company, but we quickly expanded into the community and commercial-scale solar markets." Its business is now 100% solar. It serves customers in ME, NH, VT, and NY, as a developer, doing EPC, as a contractor, and providing asset management, operations, and maintenance. It services all markets, except residential, with rooftop and ground-mounted systems, including at farms and on landfills. It does not install off-grid systems but does do battery backup on grid-tied systems. It services existing systems and can monitor systems remotely. It has installed 38 MW of solar overall, with 6.8 MW in 2021. Its website is www.aegis-re.com, with email at info@aegis-re.com.

Barrington Power, LLC – Barrington NH.

Founded in 2007, it owns and operates "over 4 MW of solar, providing discounted power to municipal, school, and commercial clients." It also has industrial clients. Its customers are in Vermont and New Hampshire. It provides developer and EPC services and has installed 5.5 MW over its history. Of that, 1.5 MW was installed in 2021. It can provide service for existing installations and can remotely monitor the systems it services. Some of its work is described in the "Profile School Solar" article on page 34 of this issue of *Green Energy Times*.

Catamount Solar – Randolph, VT.

It was founded in 2011 with three partners and is cooperatively owned, with nine employee-owners and eleven employees who are on track to become owners. Its customers are in Vermont and New Hampshire. It provides EPC and contracting services for just about any sort of customer, including residential. In its history, it has installed 17 MW of solar systems, including 1.8 MW in "more than 110 discreet solar projects completed in 2021 – all types and sizes, from small off-grid cabins to large commercial rooftops and solar fields." It can install off-grid systems and grid-tied systems with battery backup, EV charging and cold climate heat pumps. It helps customers get easy low-rate financing via VSECU. Its website is catamountsolar.com, and its email is info@catamountsolar.com.

Encore Renewable Energy – Burlington, VT.

"Encore Renewable Energy is a leader in community scale renewable energy with a proven track record in solar development from concept to completion. Founded in 2007 as Encore Redevelopment, its team specializes in the design, development, financing, permitting, and construction of solar and energy storage projects on landfills, brownfields, rooftops and carports. As a values-led company, Encore is committed to revitalizing communities and creating a cleaner, brighter future for all." Encore provides developer and EPC services to customers in ME, NH, VT, and NY. While it does not do off-grid or residential systems, it does work ranging from larger grid-tied systems with battery backup to agrivoltaic systems on farms. It is currently looking for employees. Its website is encorerenewableenergy.com, and the email address is Info@encorerenewableenergy.com.

Granite State Solar is in Bow, NH.

Founded in 2008, it installed about 10.68 MW in 2015 – 2021 and 2.4 MW in 2021. It offers EPC services to residential and commercial customers in New Hampshire. It will service systems it did not install and can monitor systems remotely. It also installs EV chargers for solar customers and can help some customers find financing. One upcoming project is a residential system in Hampstead, NH with 78 panels (34.71 kW) Its website is granitestatestosolar.com, and it can be contacted online at info@granitestatestosolar.com.

Grassroots Solar, Inc. has its office in East Dorset, VT.

It opened in 2014 and provides EPC services to commercial, municipal, non-profit, and residential customers. It will do both off-grid installations and grid-tied systems with battery backup, in addition to standard systems. It will service existing systems and can monitor the systems it maintains. "Current solar trends are towards making your own energy and storing it and using it for your maximum benefit. We enjoy helping customers do that! Another trend is people adding to their existing system as they add heat pumps or EV's." Email can be sent to info@GrassrootsSolar.com, and the website is www.GrassrootsSolar.com.

Green Earth Energy, the Renewable Energy division of McKernon Group – Brandon, VT.

The division was opened in 2006. It provides developer, EPC, and contractor services to commercial, industrial, municipal, non-profit, and residential customers in Vermont. Historically, it has installed 11 MW of solar systems, of which over 500 kW was installed in 2021. It installs roof and ground mounted PV systems, back-up and off-grid battery systems, cold climate heat pumps, and spray foam insulation. It will take on service of existing systems and can monitor the systems it services. Its email is mail@greeneearthenergyvt.com, and its website can be visited at <https://www.greeneearthenergyvt.com/>.

Green Lantern Solar – Waterbury, VT.

Its business was founded in 2011. It provides EPC and developer services for customers in ME, NH, VT, and NY. It provides installations for nearly all sorts of customers except residential. It does not do off-grid installations, but does do installations that are grid-tied and have battery backup. "Green Lantern Solar currently has over 100 solar projects operating throughout the Northeast [with] another +15MW of solar capacity in development around the Northeast." It does solar project financing, asset management, 24/7 operations and maintenance. "We have created a financing solution that allows all customers zero cost, guaranteed savings!" Its website is www.greenlanternsolar.com. Its email is info@greenlanternsolar.com.

Green Mountain Solar– South Burlington, VT.

It provides EPC services for commercial and residential customers in Vermont. It was opened by Paul Lesure in 2017, and by 2018 was installing batteries as well as solar panels. "By 2022, we have grown to about 30 people. Everyone is dedicated to providing the best solar experience for our customers. And our growth has only been possible with help from our amazing customers who tell their friends and family about their experience with Green Mountain Solar." It does not install off-grid systems, but does install systems with battery backup, heat pumps, and EV charging systems. It will service existing systems and can monitor the systems it maintains. The website is greenmntsolar.com, and email is info@greenmntsolar.com.

HAREI.org (Hillsborough Area Renewable Energy Initiative) – Mont Vernon, NH.

It is an independent non-profit organization that was founded in 2012. "HAREI has grown from a small seed of five individuals to a thriving volunteer organization with more than 30 active volunteers and hundreds of interested alumni." It offers EPC services for residences in New Hampshire. "2020 was the biggest year for HAREI solar installations with 15 completed projects and 153 KW of installed solar. About one third of those projects were ground mount arrays the rest being rooftop." It can install off-grid systems and grid-tied systems with batteries. HAREI

provides education, guidance, and other resources to people who are also willing to help others. The website is www.harei.org, and email can be sent to info@harei.org.

Maine Solar Solutions – Freeport, ME.

It was founded in 2012. "With almost ten years of experience installing solar electric systems, we've helped almost 1000 residents and businesses in Maine make the switch to solar." Its growth can be attributed to our commitment to customer satisfaction. "Our customer base is residential homeowners and the commercial market such as office and retail buildings, agricultural businesses, manufacturing, and commercial enterprises. Our solar solutions help our customers contribute to the health of the environment and our communities while saving money." It installed 9.3 MW since it opened, of which 2.4 was in 2021. It installs off-grid systems, systems with battery backup, and EV chargers. The website is www.mainesolarsolutions.com, and email can be sent to info@mainesolarsolutions.com.

New England Commercial Solar Services (NECSS) is based in Holderness, NH.

It was founded by Ted Vansant in 2014. It provides commercial, industrial, and municipal/non-profit customers in ME, NH, and VT with EPC services. Since it started business, it has installed 35 MW of solar systems, with 5 MW of that amount in 2021. It provides maintenance services and can monitor the systems it maintains. Its website is necsolarservices.com, and it can be reached by email at tec@necsolarservices.com. Some of the work it has done is described in the "Profile School Solar" article on page 34 of this issue of *Green Energy Times*.

New Hampshire Solar is in Sky Pond, NH.

It was founded in 2017. "New Hampshire Solar is a small company in central New Hampshire focused on installation of bi-facial-ground mounted arrays, grid-tied systems with energy backup in batteries, and installation of off-grid systems for residences." Since its inception, it has installed systems to produce about 5MWh, and the systems installed in 2021 will produce about 1.3MWh. "If you are within a 40-mile radius from the center of New Hampshire (New Hampton) and have a question regarding a new solar installation, don't hesitate to call!" (603-968-6031). The website can be seen at www.bit.ly/NH-Solar-ref and email can go to peter@nh.solar.

Norwich Solar has its office in White River Junction, VT.

It was founded in 2011. Norwich Technologies is the subject of articles on pages 7 and 8 of this issue, and there is a lot of information about it there. In a nutshell, this company is a technology leader, with highly educated leadership. It provides development, EPC, and financial support to its customers. It does not do residential installations or off-grid systems. It

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has installed over 40MW of solar systems since it started, including 7MW in 2020 and 9.2MW in 2021. Asked if it had newsworthy projects coming up in 2022, its one-word reply is "Yes!" The website is norwichsolar.com, and email can be sent to info@norwichsolar.com.

The Plymouth Area Renewable Energy Initiative (PAREI) – Plymouth, NH.

It started operations in 2004. PAREI provides "Solar and energy efficiency education and project coordination/consultation, solar PV installations for residential/non-profit members (10 to 12 annually)." It has installed 1.2 MW since 2009, when it started with solar photovoltaics, with 153 KW of that in 2020 and 2021. It does not do battery or off-grid installations. "We provide services to residential and non-profit organizations in the Plymouth, NH and adjoining towns." Its main website is plymouthenergy.org, but the website for the solar section is nhsolarshares.org. Email can be sent to sandra@plymouthenergy.org.

ReVision Energy – South Portland, ME and four other locations in ME, NH, & MA.

Founded in 2003, it is employee owned. It does developer, EPC and contracting, serving commercial, industrial, municipal, non-profit, and residential customers. It has installed 135 MW of solar panels since 2003, and 29.7 MW in 2021. It installs grid-tied systems, including those with battery backup. It also provides an array of other clean energy systems. "We offer free site evaluations where we discuss any clean energy technologies that our customers may be interested in, including battery backup, heat pumps, heat pump water heaters, and EV chargers. We also offer financing for our products sold, assistance with REAP grants, and power purchase agreements for nonprofits/municipalities." Email contact is hello@revisionenergy.com and the website is www.revisionenergy.com

Solartech is located in Sutton, VT.

It was founded in 2009. Since that time, its growth has been driven by satisfied customers who shared its contact information, and it now has five employees. It focuses on design, installation, and service to residential customers in Vermont. It installs off-grid and grid-tied systems and can include battery backup. It can provide service for existing systems and can monitor the systems it maintains remotely. Solartech is an independent, family-owned small business run by people who have lived an energy-independent lifestyle for over 25 years, with home and office powered by the sun. The website is solartechvt.com and email should be directed to rich@solartechvt.com.

South Pack Solar is in Peterborough, NH.

Since it opened in 1998, it has installed about 500 systems. Its work has been primarily in New Hampshire's Monadnock Region, but it has done work in MA, CT, VT, MD, CA, and CO. It provides developer, EPC, and contractor work to commercial, industrial, municipal, non-profit, and residential customers. "We typically build between 30 and 40 systems a year all in conjunction with local craftsman. This relatively small scale allows us to take the necessary time to design and construct the best built and best value system for our customers using the appropriate technology for the particular site." It can do off-grid systems and install battery backup on grid-tied systems. The website is www.southpacksolar.com, and email can be sent to greg@southpacksolar.com.

COMMUNITY SOLAR



Community solar array in Mechanicville, NY has 18,500 panels producing 6.12MW, enough power for 1,000 residential customers. (Photo: Chris Cusack). www.bit.ly/GET-Community-Solar-4-2020.

COMMERCIAL SOLAR



RGBC Associates in Keene, NH installed a 107kW solar array on the EMF building. (Photo: Albert Karevy). www.bit.ly/GET-Commercial-Solar-4-2020.

RESIDENTIAL SOLAR



The Ouellette home features 27 solar panels along with two Powerwall batteries. (Courtesy photo). www.bit.ly/GET-RooftopSolar-Nov2020

SCHOOL SOLAR



Phillips Exeter Academy is home to the largest New Hampshire school solar array with 1,552 panels. (Photo: ReVision Energy). www.bit.ly/GET-School-Solar-2-2018.

CHURCH SOLAR



The Unitarian Universalist Church of the Upper Valley has a rooftop array consisting of 45 panels providing a total power of 15.75 kW DC. (Photo: Norwich Technologies). www.bit.ly/GET-Church-Solar-1-2019.

Southern Vermont Solar is in Westminster West, VT.

It was founded in 2017. "We've experienced steady growth since we started SVTSOLAR in 2017. We are committed to serving our local area in order to provide optimal solar and battery storage services and a personalized, responsive, and thoughtful customer experience." Its work is primarily in Vermont, but it will work in other states in the G.E.T. distribution area. Its specialties are solar installation and battery services for residential, utility, non-profit, and commercial systems. SVTSOLAR does not install off-grid systems. It can service existing systems and can monitor systems for current customers. Its website is svtsolar.com, and it can be contacted at info@svtsolar.com.

SunCommon is based in Waterbury, VT.

It went into business in 2012. "Homeowners and businesses in Vermont and New York have responded really well to the top-quality service and products we offer, allowing us to grow every year." It provides developer, EPC, and contractor services to commercial, municipal, non-profit, and residential customers. It can install grid-tied systems with battery backup. In 2021, it installed 10 MW of residential and commercial solar, and energy storage at nearly 200 homes. It can service existing systems and can monitor them remotely. "We offer financing to all of our customers, making it easier to go solar, install energy storage or install EV chargers." Its website is suncommon.com, and its email address is solar@suncommon.com.

Sundog Solar has its office in Searsport, ME.

It was founded in 2009 by a father-and-son team, Chuck and Danny Piper. Their goal is to make solar energy affordable and available throughout Maine. "We have since installed hundreds of solar energy and heat pump systems and are one of Maine's most experienced solar companies. We service Bangor, Ellsworth, Rockland, Camden, Rockport, Bar Harbor, Bath, Augusta, Maine, and surrounding areas." Sundog Solar provides developer, EPC, and contractor services to commercial, municipal, non-profit, and residential customers. Over its history, it has installed over 56 MW of solar systems, with a total of 9.7 MW installed in 2021. It will install off-grid and battery backup systems, EV chargers, and heat pumps. It helps with power purchase agreements and financing.

"Our motto is, 'There is never enough solar until every rooftop, parking lot, and sustainable space is being used for our clean energy future.'"

We at G.E.T. hope you will use this list. It will be available on our website. And watch for feature articles on these installers in future issues of *Green Energy Times*, so you can know them better and understand what they do. To our solar installers, we say, "Thank you for all you are doing." And to our readers, "Thank you for considering installing solar and your support for clean, renewable energy." ☀



International Becomes Local at Global Climate Conference

Rob Werner

The city of Glasgow, Scotland, became the center of global climate change action negotiations during the first two weeks of November. The agreement that emerged from many rounds of intense discussions among nearly 200 nations has been met with mixed reviews. Despite new momentum on some fronts, COP26 (United Nations Conference of the Parties) delivered incremental progress when climate science clearly demands big breakthroughs.

One outcome of COP26 is certain: The fight for ambitious climate action continues, and it will be led by governments, organizations, and individuals on the local level. The upward pressure of local climate action on national governments across the globe is essential for true progress to be achieved.

I was honored to participate in COP26 as an observer. The swirl of activity inside and outside the conference venues was at times overwhelming, and the urgency for action was palpable. Indeed, the United Nations Intergovernmental Panel on Climate Change (IPCC) Special Report on Global Warming found that emissions reductions of approximately 45% by 2030 from 2010 levels are consistent with keeping the rise in global temperatures within the 1.5°C threshold from pre-industrial levels, above which multiple and truly catastrophic impacts of climate change will follow. Countries are making progress toward these critical temperature goals first included in the Paris Climate Agreement, but not nearly fast enough. The global temperature has already risen by 1.1°C, so we have little margin for error remaining and much work to do to avoid the worst outcomes of climate change.

I spent much of my time conferring with fellow local elected officials from both the United States and across the globe under the banner of the LGMA (Local Government Municipal Authority) constituency. While nations set the carbon emissions goals necessary under



Youth protesting against the pollution of the world. (mockcop.org)

the COP process, it is the specific and concrete initiatives of local governments across the globe that create success, and local governments are the true implementors of climate change action. Here in New Hampshire, cities and towns such as Concord, Hanover, Keene, and Peterborough are leading the way, making ambitious 100 percent renewable energy commitments and pursuing projects to make that real. I found a great deal in common among the efforts we see here in New England to move toward a clean energy economy and global efforts to do the same.

A prominent feature of this COP was the insistent and constant demands of young people for aggressive climate action in the streets of Glasgow outside the formal negotiation venues. I'm told by COP veterans that the outside actions have become ever more important in these gatherings to keep pressure on negotiators to stay at the table and keep agreements on track. Generation Z – the population group born between 1996 and 2010 – became the largest and most diverse generation on the globe last year, comprising 32% of the global population. While the oldest members of Generation Z are just 24 years old,

their influence is already being widely felt and they are finding their voice. After all, it is their future that is seriously compromised by our climate change inaction.

Bringing it Home to NH

A consistent theme at COP26 was the need for energy efficiency efforts to be substantially brought to scale

in the built environment to reduce the demand for energy. The adage that “the least expensive unit of energy is the one that is not used” is appreciated across the globe, and municipalities are the leading edge of efforts to strengthen building codes and require clean energy components in building construction that increase energy efficiency. While in Glasgow, I learned of the astounding news that the New Hampshire Public Utilities Commission issued an order that absolutely decimates support for New Hampshire's energy efficiency programs. The PUC order follows the efforts of some of our New Hampshire state legislators to undermine energy efficiency programs that have proven their worth over many years, saving money for residents and businesses while reducing the overall demand for energy. From afar, the dissonance caused by the rejection by the NH PUC of the most basic principles of how current investment creates future benefits was very unsettling.

The re-emergence of the United States on the international stage as a result of rejoining the Paris Climate Agreement was very welcome in Glasgow. International trust has begun to be rebuilt, and the importance of American leadership cannot be

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underestimated. As the world's second largest carbon emitter, we must enact serious climate action and clean energy policies here at home to successfully claim legitimate and credible leadership. The United States is on the path to doing just that with the recent enactment of the infrastructure bill and the progress of the Build Back Better budget in Congress as both initiatives include unprecedented investments in climate action and clean energy.

COP26 delivered some progress amidst a challenging geopolitical backdrop and difficulties caused by the ongoing COVID-19 pandemic. The final pact adopted in Glasgow calls for nations to strengthen their emission reduction targets by the end of 2022, recognizes the need for the reduction of the use of fossil fuels and the acceleration of renewable energy sources, and calls on governments to incorporate the critical role of nature and biodiversity in plans to keep the 1.5 C threshold within reach. Left unresolved by COP26, discussions will continue in the run-up to COP27 in Egypt next November on some very big issues, including global climate finance as well as financial support for loss and damage experienced by developing nations.

Local action to implement state, national, and international climate and clean energy goals will continue to be the most important venue for developing practical and sustainable solutions. Positive outcomes for our citizens here in New Hampshire and beyond that will protect our precious earth while creating economic opportunity and jobs are well within reach. Let's work together to ensure our future.

Rob Werner is the New Hampshire state director for the League of Conservation Voters and serves as a city councilor in Concord.

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HOW YOU DO IT!

Cont'd from p.1

mechanisms to capture the full benefits of energy storage.”

Green Hydrogen: With the federal government possibly putting up \$10 billion for green hydrogen projects, New York will act to leverage some of that funding. Among the areas of development, two in particular stand out. One is development of microgrids based on renewable energy and green hydrogen. The other is district heating and cooling. Also, New York will develop a regulatory framework for green hydrogen.

Fossil Fuel Plant Phase-Out: New York will repurpose or close its oldest and most polluting fossil fuel power plants by 2030. Energy storage will be used in conjunction with the closures to enhance system reliability. NYSERDA, the Department of Public Service, and Department of Environmental Conservation (DEC) will also develop a blueprint to guide the retirement and redevelopment of New York's oldest and most-polluting fossil fuel facilities and their sites by 2030.

Clean Buildings: The state will require all new construction have no greenhouse gas emissions by 2027.

Also, the current rate of electrification of about 20,000 homes per year will be increased more than tenfold by the end of the decade. New York State will have two million climate friendly homes by 2030.

Clean Green Schools: The state will launch an expansion of the Clean Green Schools proposal through a proposal to inject new Environmental Bond Act funding to over 1,000 public schools located in disadvantaged communities. This will bring benefits through geothermal heating and cooling, solar power, green roofs, indoor air quality and ventilation, electric school bus charging, and more, creating thousands of high-quality green jobs. The governor makes clear that the state will seek to have all new school buses purchased be zero-emissions vehicles by 2027, and all school buses used have zero-emissions by 2035.

Electric Vehicles: The state of New



School bus converted to electric. (Unique Electric Systems)

York will invest over \$1 billion to support EV adoption and infrastructure. It will also expand the electric vehicle light-duty fleet to 100%. All such vehicles purchased from 2027 on will

be electric, and all of them in use will be electric from 2035 on.

Hunts Point Decarbonization: The Hunts Point Food Market in the Bronx is the largest food distribution center in the U.S. Over 15,000 diesel trucks enter the facility every day. NYSERDA and the New York Power Authority will lead an effort to develop solutions to “transform Hunts Point Food Market into a Clean Distribution Hub that is quieter, cleaner, and healthier for the entire community.”

Extreme Heat Action Plan: NYSERDA will work with the DEC to develop “an Extreme Heat Action Plan to address heat in disadvantaged communities, areas of employment, and recreational zones across the state.”

Some of the Other Proposals:

Sustainable Finance: achieve net-zero in state investment portfolios by 2040, prioritizing green bonds, and encouraging contractor climate risk disclosure.

Sustainable Procurement: Strengthen green procurement standards for state agencies – issuing a new executive order on green procurement in state government to align with strong climate commitments.

Battery Research: Create a world-class battery research and manufacturing center at Binghamton University, establishing BATTERY-NY, a technology development and manufacturing center hosted by Binghamton University and led by Professor Stan Whittingham and NY-BEST.

We should make clear that not all funding for these proposals will come from the state. New York will leverage funding from other sources, such as private investment and the federal government.

We at *Green Energy Times* applaud Governor Hochul for her leadership and her team in the state government for its hard work. We hope this effort will prove to be an example for all states. ♻️

Humans and Oil: How Did We Create This Mess?

Janis Petzel, M.D.

In medicine, homeostasis or the stable balance between interdependent elements, is the sign of a healthy body. Imbalance causes illness and disease. The global equivalent to homeostasis is sustainability. I view climate change as a sign of imbalance and dis-ease in our world's various ecosystems. The cause? Carbon pollution from the burning of fossil fuels. Wild-fires, sea level rise, floods, droughts are all manifestations of the malignancy of carbon pollution.

Over the next several issues of *Green Energy Times*, we will explore together ideas on how we got to this unbalanced state, and most importantly, what we can do about it.

My medical training tells me that it's difficult to diagnose and cure an illness if you don't have a good history from the patient. So, let's look at the history of humans and oil.

The word petroleum comes from ancient Greek for "oil rock." As anyone who has visited the La Brea Tar Pits (or who has watched *The Beverly Hillbillies*) knows, there are places in the world where oil seeps out of rocks close to the surface of the earth. When exposed to air, the seepage thickens into a tarry substance called bitumen, pitch or asphalt.

We don't know when humans first figured out how to use the bitumen, but it



Natural tar seep at the McKittrick Oil Field, CA, north of Hwy 58. (Wikimedia Commons/Lldenke)

was thousands of years ago. Bitumen-coated flint tools from the Syrian desert have been dated to 40,000 BC. In the Book of Exodus, Moses' mother placed her baby in the Nile in a floating basket waterproofed with pitch.

At least 6000 years ago, people living along the Euphrates River in what is now Iraq used bitumen from a seep called "Fountain of Pitch." The Babylonians built waterproof homes with bitumen, brick and mortar. Sticky bitumen was used in the ancient world to hold arrows and weapon heads on to handles, to create flaming arrows. It was used to make jewelry and mosaics. The stones of the pyramids of Egypt are held together with bitumen cement. The Egyptians also used oil products for embalming mummies. Ship builders waterproofed reed boats, and later

wooden sail boats with tar from pitch. Sailors got so coated with the stuff that they became known as Tars.

By the 10th century in the Middle East, Islamic chemists knew how to distill petroleum. Marco Polo passed by Baku, Azerbaijan in 1273 and recorded oil fields, with oil mined through shafts.

The Chinese may have been the first to drill for natural gas. Roughly 2000 years ago, when they were mining for salt brine for table salt, they stumbled upon natural gas deposits. Using bamboo pipes, they burned the gas for light, heat, and to boil off the water in the salt brine.

Indigenous people on the continents of South and North America used petroleum from seeps to create weapons, ceremonial body paint and fires long before the arrival of Europeans. When Europeans finally got to North America, they purchased medicinal Seneca Oil created from petroleum by Seneca tribe members in upstate New York or from Iroquois people in Pennsylvania.

From the 16th to the 19th centuries, train oil (whale oil) was used for lamps as well as soaps, lubricants and varnish. But whale oil was smelly and became harder to get when whales were overhunted almost to extinction. "Rock oil" cost less, and as awful petroleum products smell, they were an

improvement over the stench of whale oil.

But until the Industrial Revolution in Britain in the late 1700's, human use of fossil fuels depended mainly on found surface deposits of oil and was not enough to disrupt the global environment. In an article from the Geological Society, Jonathan Craig and colleagues note "methods used to produce petroleum in Europe remained almost unchanged between the sixteenth and the first half of the nineteenth century. Basically, it was a craft activity, carried out without specific mining tools that yielded limited quantities of petroleum... it was not sought out, but simply found in the ground."

But advances in what came to be called organic chemistry (the chemistry of carbon-containing compounds like oil and coal), and ironically, the invention of the coal-powered steam engine, which allowed for drilling through rock to get to the oil beneath Titusville, PA in 1859, changed all of that.

We'll talk about how we went from thousands of years of "craft" petroleum use to the mass production of petroleum products and automobiles in less than 100 years in our next installment of this series in the April issue of *Green Energy Times*.

Janis Petzel, MD lives in Islesboro, Maine where she strives to walk the walk to a fossil-fuel free future.

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

BOOK REVIEW: FREEING ENERGY

Freeing Energy, How Innovators are Using Local-Scale Solar and Batteries to Disrupt the Global Energy Industry from the Outside In

by Bill Nussey, Mountain Ambler Publishing, 2021.

Review by Janis Petzel, M.D.

Freeing Energy by Bill Nussey couldn't have come out at a better time. As our elected representatives in Congress spin their wheels on Build Back Better, and California seems poised to go off the deep end by threatening to assassinate net metering, Nussey's easy-to-read book offers a way forward for everyday people who just want to do the right thing for the environment. It's practical, hopeful, motivating, useful, well-written and fun to read. He takes a complex topic, the world of electricity, and makes it accessible for those of us who are not electrical engineers.

Nussey is an electrical engineer. He's also a former tech CEO, venture capitalist and philanthropist who turned his attention to solar power after a visit to rural Africa, then having an epiphany about the future while he was a VP at IBM. After my disappointment with Bill Gates' book, *How to Avoid a Climate Disaster*, I was prepared for yet another rich white guy trying to show us all how smart he is.

But this book is nothing like Gates' book. Nussey is like your favorite teacher—passionate and knowledgeable about his subject, with contagious enthusiasm and injections of humor to make a point (for example, A Monopoly Parable, where a fictitious company named McDunald's worries about data that their hamburgers are unhealthy. The company starts a

disinformation campaign about salad because lettuce only grows part of the year). He explains his material in a way that we can all get without dumbing it down.

The book opens in Puerto Rico in 2017 after category 4 Hurricane Maria. Many parts of the island were without power for nine months. Hard to imagine how they survived.

Nussey visited a school in the small town of Naranjito, which managed to install a microgrid of solar panels and battery storage during the post-hurricane chaos, and the community blossomed.

Thus, Nussey introduces the concept of local energy. He writes, "It is about individuals, communities, and local businesses generating their own energy. It is about choice and fair markets. It is about unleashing innovation in our outdated electric grid. It is about all of us finally taking control of one of the most essential parts of our lives—energy."

Local energy—the solar panels on your own roof or from community solar—is rapidly becoming the "cheapest and most reliable way to provide most of the power to the homes and buildings of the 70% of Americans who live in suburbs and rural areas." That's us, G.E.T. readers!

Freeing local energy, Nussey writes, does not require government handouts or the dismantling of utilities—in fact, it can benefit utilities as well as customers. Locally generated electricity is more reliable given

weird weather. It's cheap and getting cheaper. And most important, it's fair to all parties.

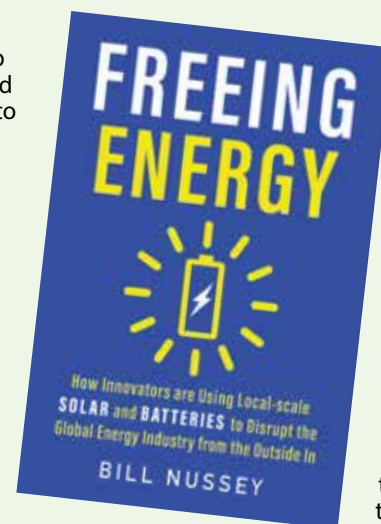
Across ten chapters, *Freeing Energy* walks the reader through the history of electrical power in this country, why the current system is failing people, the rise of innovative technologies, which he calls "billion-dollar disruptors," and why "bloated US residential solar costs" are so high compared to Australia's (but still cheaper and cleaner than fossil fuel-generated electricity).

The excellent final third of the book deals with the future and how to make use of his information. He includes a "Local Energy Bill of Rights" and ideas on how to reinvent electric monopolies and the Big Grid, which he says is still essential for industrial power needs and in urban areas.

I found this book to be eye-opening for finding ways to communicate about green energy. In fact, I've started a list of ideas from the book that I want to talk to my state representative about.

The chapter, "The Battle for Public Opinion" shows why myths about solar and clean energy are inaccurate, a big help for those of us who get tongue-tied in an argument and need backup.

Given Maine's recent battles with Central Maine Power over net metering, an investor-owned utility, the chapter on "Utilities Versus the Future" was especially pertinent to current events. Chapter sub-



headings like Goliath Roars, David Roars Back, Jungle Warfare and Grid Defection, and the Death Spiral, paint a vivid picture of what local energy supporters are up against.

I've already used what I've learned from this book as I serve on my town's energy committee. We're asking the town to install conduit and circuit breakers for solar, electric vehicle charging and battery storage up front rather than trying to retrofit later as we design a new town building.

Nussey suggests this approach for any new construction, residential included.

We've been through a battle over net-metering in Maine, and now it's California's turn. If net-metering is on your radar, I suggest you read pages 217 through 219, and check out Nussey's website which also provides information on where you can purchase this book: <https://www.freeingenergy.com> which has a page on net metering <https://www.freeingenergy.com/share-net-metering/>. I hope you do buy this book. You will find it time and money well-spent.

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. ♻️

CLIMATE CHANGE AND LOCAL ACTION



Dr. Alan K. Betts

In December 2021, I reviewed how little progress was made at the Glasgow COP26 talks on reducing carbon emissions that are driving extreme climate change. The fossil empire kept the discussions well under control, since burning all the fossil fuels is the key to their trillions in profits. So let us review the climate disasters and extremes of 2021, for which the fossil empire and business-as-usual capitalism bears responsibility. U.S. greenhouse gas emissions rose 6.2% last year compared to 2020 (which was affected more by the coronavirus), and oceans' temperatures reached their highest level on record.

Wildfires, hurricanes, tornadoes and a winter storm and cold wave were among 20 weather and climate disasters in the U.S. last year that cost \$1 billion or more, totaling \$145 billion and killing 688 people, according to NOAA. Specific events include extreme temperatures in the Northwest U.S. and Canada, wildfires and drought in the West, Hurricane Ida, three separate tornado outbreaks in the South and central parts of the U.S. In addition, unusually cold temperatures in Texas in February left millions of people without electricity, but successfully destroyed refineries. Hurricane Ida alone did more than \$60 billion in damages as it targeted both the oil wells along the Texas and Louisiana coasts, and the NY-NJ urban infrastructure and financial institutions that are funding the destruction of the Earth by the fossil fuel companies.

Extreme records for temperature are falling globally every year. July 2021 was the world's hottest month: 1.67oF (0.93oC) above the 20th-century average. The event in late June in the northwest U.S. and Canada was described as "most anomalous regional extreme heat event to occur anywhere on Earth since temperature records began" (weather historian Christopher Burt, author of the book *Extreme Weather*). The forest town of Lytton, B.C. on June 29, 2021 burnt down as temperatures rose to 121oF (49.6oC). This set a new high temperature record for Canada, a stunning 8oF above the previous Canadian record. Across Washington State, many other records were also broken by 8oF. The



In February 2021, Texas experienced some of the coldest temperatures in parts of the state in more than 100 years. (eyeopeningtruth.com)

world's highest (and North America's highest) reliable temperature at 129.9oF degrees (54.4oC) was again reached in Death Valley on July 9, 2021. As I write, Onslow, a small coastal town in Western Australia, registered 123.3oF (50.7oC) amid a severe heat wave, setting a new record for the southern hemisphere. In contrast here in Vermont a huge rain, ice and snow storm covers the eastern U.S. and Canada.

The climate of the past is moving into history and the practice of forecasting new climate extremes before they actually occur is extremely difficult. To those with a dark sense of humor, it is almost funny because we refuse to face what humanity is actually doing. One new pretense for example is using artificial intelligence and big computers for forecasting, but the reference information is necessarily historic! The deeper paradox is that the Earth seems now to be selecting strategies to destroy fossil infrastructure to protect its interests. This is obvious to indigenous people, but it is heresy to capitalism, which thinks it is smart to make a lot of money exploiting and destroying the Earth.

The February freeze in Texas is a good example. This originated in the stratospheric oscillation over the North Pole, propagated down into the Arctic troposphere and then southward as a series of freezing blobs that sat over Texas, freezing and destroying infrastructure for two weeks. Texas had never seen anything like it, and its infrastructure was not winterized. Much of the electrical power system shut down (as it is largely iso-

lated from the U.S. grid), and estimates of the total damages were \$195 billion (which I note is larger than the total U.S. damage figure for 2021 above!). But from the Earth's perspective, the real target was the Texas oil refineries, which suffered more damage from this February storm than any major hurricane.

The extensive fires in North America are increasing the risks of devastating mudslides across large areas. The Dixie fire in California alone burnt nearly a million acres (400,000 hectares) and studying the landslide impacts on this scale is a huge measurement and forecast issue, as it depends on soil type and vegetation coverage, as well as rainfall intensity. Fires can reduce the permeability of the soil surface so that subsequent intense rain rates form streams that carry soil and rocks downhill generating mudflows. In landscapes which were forested this process can be delayed until the tree root systems decay, which may take a few years. The extreme temperatures in British Columbia in late June and into July led to many fires that burnt and destabilized hillsides. Then a huge storm in mid-November 2021 from an atmospheric river off the Pacific dumped a month of rain on the region in two days. This generated massive mud and debris slides that closed the Trans-Canada Highway and national railway line. To us a 'supply-chain interruption' but useful from the Earth's perspective as British Columbia is mining and liquefying natural gas to speed the destruction of the climate. We are moving into a new era of long-term consequences from

our destruction of the Earth's climate system for profit. Another different example is that a recent detailed global study shows that the anthropogenic intensification of daily rainfall extremes has a 'surprising' negative global economic impact. Our relatively simple economic models do not yet monitor local daily rainfall.

In sharp contrast, I have been exceptionally busy for two months taking over and planning the repair of a local community solar array. This small 150kW array was set up in 2015 by the Clean Energy Collective (CEC) by selling 300W panels to fifty members of the community. I myself own twenty panels (out of 684). We were promised twenty years of renewable electricity credits through the utility Green Mountain Power, who takes the entire production. We the community investors were doing it to support the transition to renewable power, but CEC was doing it for short-term profit, not the long-term interests of the Earth. It stripped all funds it could from panel owners, long-term escrow accounts, stopped maintenance as inverters failed and then filed for bankruptcy for the three arrays in owned in Vermont. I noticed power production was down in the summer of 2021, and initially I thought it was the cloudy summer. As soon as I heard of the bankruptcy filing, I did a deeper analysis comparing with other Vermont sites. I found a sharp 25% drop occurred in May 2021, when in fact two inverters had failed (out of seven). I took over the array on behalf of our West Haven Solar Array Community, and we are developing a long-term strategy that is in the interests of the Earth.

Dr. Alan Betts of Atmospheric Research in Pittsford, VT is a climate scientist. More at alanbetts.com. ☞



A long-term strategy that is in the interests of the Earth is being developed for the West Haven, Vermont 150kW community solar array. (Alan Betts)

USDA HIGHLIGHTS ACCOMPLISHMENTS TO COMBAT CLIMATE CHANGE IN RURAL AMERICA

On January 18, the U.S. Department of Agriculture Rural Development, under Secretary Xochitl Torres Small, recently highlighted a-year of accomplishments to combat climate change and increase resiliency throughout rural America.

"At USDA, we know people in rural communities are on the frontlines of climate change and increasingly face severe weather that threatens their safety, health and livelihoods," Torres Small said. "By investing in climate-smart infrastructure, rural leaders are taking charge. USDA is proud to invest in locally-driven solutions to create good-paying, lasting jobs and build back better and more resiliently in these rural towns for decades to come."

USDA Rural Development has taken several steps since January 2021 to address climate change in rural America, including:

- Investing \$687 million through the Rural Energy for America Program to help rural businesses purchase and install energy efficiency upgrades and renewable energy

systems like solar. (www.bit.ly/Rural-climate-change-1)

- Investing more than \$47 million in grants across 31 states to add almost a billion gallons of higher blends fuels to the market through the Higher Blends Infrastructure Investment Program. (www.bit.ly/Rural-climate-change-2)
- Investing \$241 million in renewable and energy storage loans through the Rural Utilities Service. These investments include 13 solar projects totaling \$199.8 million, one \$4 million hydroelectric project and one \$38 million battery energy storage system.
- Creating a new pilot program to support clean energy in underserved rural communities. The pilot program will be launched early 2022.
- Celebrating the 10th Anniversary of the BioPreferred certification and labeling program by adding more than 270 new companies to bring the total to 3,200 companies from 47 different countries. (www.bit.ly/Rural-climate-change-3)

- Unveiling a Disaster Resource Guide detailing assistance available to rural people, businesses and communities impacted by disaster and support for long-term planning and recovery efforts. (www.bit.ly/Rural-climate-change-4)

These and other investments in 2021 have benefitted hundreds of thousands of rural people in every state and U.S. territory. For example, they have helped bring safe water to communities in Alaska, repair hurricane-damaged landfill facilities in Puerto Rico and provide low-cost, clean solar power to people in Illinois and Texas.

In the coming year, USDA Rural Development will continue to strategically focus on integrating climate outcomes into its work by expanding clean and reliable energy generation and increasing renewable fuels production and infrastructure to the benefit of rural and Tribal communities.

USDA touches the lives of all Americans each day in so many positive ways. USDA is transforming America's food system with a

greater focus on more resilient local and regional food production, fairer markets for all producers, ensuring access to safe, 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.

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. ☞

WHAT ARE THE GEOTHERMAL OPERATING COSTS?

Joe Parsons

If you're wondering what geothermal heating costs, then you may already know that switching to an eco-friendly option requires some investment. According to energy.gov, reducing heating costs by as much as 50% and cooling costs by more than 35% compared with a conventional system is the top reason for choosing geothermal.

So how do you get the return you're looking for? The key to saving money on any home heating and cooling is energy efficiency. The more efficient your HVAC system is, the more bang you'll get for your buck.

All energy delivered with a combustion-based furnace comes from the consumption of a fuel source, whether it's natural gas, propane, or oil. Geothermal heat pumps don't generate heat—they just transfer it from the ground into your home. Only about one-third to one-fourth of the energy delivered in heating with a geothermal system comes from electricity consumption. The rest is extracted from the ground. With a geothermal heat pump, there's no onsite combustion and therefore no emissions of carbon dioxide, carbon monoxide, or other greenhouse gases.

While a typical furnace consumes a very small amount of electricity to power the fan and other minor electrical components, most of the heat is generated through combustion. A geothermal heat pump uses electricity to power the compressor, fan, and circulating pumps. These important components help the heat pump move heat from the ground and bring it into the home through the vapor compression and refrigeration cycle.

So, if geothermal heat pumps are more efficient than furnaces, why do they consume more electricity, and how does that affect your monthly bill?

How Much Electricity Does a Home Geothermal System Use?

Electric usage will vary based on climate and seasonality. In a heating dominant climate (like upstate New York), about 50% of the additional electric usage attributed to your geothermal system will be consumed in just three months: December, January, and February. In fact, it's normal if your December electric usage with geothermal is four times greater than what you used



Geothermal heat pumps can save up to 70% on your annual energy bill. (ClimateMaster, Inc.)

the previous December heating with an oil furnace.

For example, if your December 2019 electric usage was 500 kWh, it might be 2,000 kWh in December 2020 after upgrading to geothermal. However, without spending any money on oil or propane, your overall heating expenses for the year will be much lower!

Let's take a look at a typical 2,500 square foot home in Cortlandt, NY which previously had a fuel oil furnace and central air conditioning before installing geothermal. If the furnace was 15 years old and operating at 75% efficiency due to wear and tear, this home will now use an additional 7,000 kWh of electricity annually while still saving over \$1,500 or 47% of their total heating and cooling costs over the full year with geothermal heating and cooling.

Using Less Electricity for Cooling Than Conventional Air Conditioners

Geothermal heat pumps are more efficient and use less electricity for cooling than even hyper-efficient central AC systems. That's because standard AC units remove hot air from your home and release

it into the hot outdoors, while geothermal heat pumps move the hot air into the 50°F ground where it's more easily accepted.

A typical central AC has a SEER rating of 14-16, while a geothermal heat pump system has an average EER rating of 20-30. Because of this increased efficiency, homeowners with window units, wall units, or traditional central AC prior to installing geothermal usually see their electric usage decrease in the summer.

Using More Electricity for Heating Than Conventional Heating

Electric usage will increase with geothermal in winter months, but the additional cost won't be divided equally throughout the year. Because your electric bill will be lower in the summer than you paid previously, you'll be spending less money overall than when heating and cooling with a conventional system.

Heating costs and the savings associated with a geothermal system are relative to energy prices. As the prices of natural gas, propane, and heating oil increase with respect to the price of electricity, the savings associated with getting geothermal increase too. Historically, the rise in electricity prices

Many thanks to our renewable heating section sponsor:



has been slow but steady while natural gas, propane, and heating oil prices tend to be more volatile. For example, it's not unusual to see articles on rising oil prices during political or economic disturbances.

What Else Can Impact Your Electric Bill with Geothermal?

Many homeowners are used to adjusting their thermostat for when the family is sleeping, or perhaps they set it at a different temperature for when they plan to be away from the house. This practice, known as thermostat setback, saves money and energy when operating a fossil fuel furnace. But a geothermal system will run most efficiently when the thermostat is kept at a single temperature set point throughout the day.

Thermostat setback is counterproductive when operating a geothermal system. Unlike a furnace, a geothermal system is carefully designed to meet a home's precise heating and cooling needs. To recover from a setback period, a geothermal system will likely need assistance from a supplemental heat source like an electric resistance heater. As a result, thermostat setback forces the geothermal system to frequently rely on expensive supplemental systems, unintentionally increasing the average cost of operation. It's best if homeowners set a geothermal thermostat at a steady temperature.

Conclusion

Geothermal heating and cooling systems can save up to 70% on your annual energy bill. With the rising costs of fuel oil, propane, and natural gas, and considering available federal and generous local utility incentives, now could be the best time to invest in a geothermal system.

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

Climate Crisis Cost

Cont'd from p.1

from <https://mck.co/3ggx8Bc>.

It is not an easy report to read for several reasons. One is the fact that it puts the possibility of failure into sharp focus. We can fail. And if we do, the consequences will predictably be bad, and possibly very bad. The report says that perhaps as much as 20% of the global gross domestic product (GDP) would be in danger, unless we get emissions under control. It also says that 20% is not a worst-case. The worst case is not estimated.

To avoid devastating change, we have to put a lot of effort and money into action. Doing that, however, is not the same sort of thing as paying for climate damages. When something is damaged and needs to be replaced, the cost of doing so includes money lost. Investment into infrastructure that will reduce carbon and methane emissions, however, is not money lost; it is money invested.

Another thing to remember is that the investments we make in facilities that reduce carbon emissions will largely be

made to replace facilities that need replacement anyway. For example, a coal burning power plant that is fifty years old might be replaced by an extensive solar photovoltaic (PV) system with storage instead of replacing it with a new plant powered by coal or gas.

The report says that all carbon dioxide and methane emissions come from seven systems: power, industry, mobility, buildings, agriculture, forestry, and waste. All of these systems have to be transformed.

As readers of *Green Energy Times* probably would know, transforming the power industry means getting the most from renewable energy sources, while we eliminate gas and coal. We address mobility in every issue of G.E.T. in the transportation section, where we advocate a switch to electric vehicles. Weatherization and such efficiencies as heat pumps are often subjects of articles in the building section. Agriculture is covered in its own section, and industry, forestry, and waste are covered in the Green Living section.

We have plenty of reasons to make the

transition away from fossil fuels, even without thinking about the climate crisis. Costs for renewable energy systems have gone down to make them the least costly sources of electricity we have, and according to Wright's Law (which is not mentioned in the McKinney report) they will most likely continue to fall. Pollution from fossil fuels is costing this country thousands of lives each year and contributing to sickness costing many billions of dollars in medical bills and lost work each year, worldwide.

Considering the cost of climate change, however, we have an entirely different set of reasons to end our use of fossil fuels. Their cost is not just what is paid for the product. It also comes as floods, wildfires, droughts and other problems that increase relentlessly, costing this country billions of dollars each year, and the rest of the world similarly great amounts. These are called "external costs."

With that background we can look at some numbers. Exclusive of external costs, worldwide annual spending on energy includes about \$2.7 trillion on high-emissions

assets, \$2 trillion on low-emissions assets, and about \$1 trillion on reallocating assets from high-emissions to low-emissions. So, our current spending on energy is about \$5.7 trillion each year.

To address the climate crisis adequately, we will have to increase that \$5.7 trillion by an additional \$3.5 trillion, to \$9.2 trillion, each year for the next thirty years. This amounts to an average increase in energy costs of just over 60% to save the planet.

Please bear in mind, however, that the increase is not a loss; it is an investment with benefits of its own. One benefit foreseen in the McKinsey report, for example, is 15 million jobs, globally. There are economists who point out that the amount of investment, over the time during which it is to be made, could produce an ongoing era of prosperity, worldwide.

The McKinsey report is not the only one estimating the cost of dealing with the climate crisis. Others studies agree with it. But we should remember that every day we delay makes climate change worse and stopping it more costly. ♻️

ELECTRIC THERMAL STORAGE HEATING

Richard de Grasse, PE

Electric Thermal Storage (ETS) heating refers to the process of converting electricity to thermal energy and storing it as heat in high temperature, high density ceramic bricks. ETS systems are designed to use low-cost, off-peak electricity, when the demand on the electric grid is low, for heating a home or business 24 hours a day.

In 1971 I was appointed deputy commissioner of the Vermont Public Service Board (PSB) by then Governor Dean C. Davis. I was an electrical engineer and looked forward to serving on the Vermont utility regulatory commission and with Vermont electric utilities. During my term, I became host to an Australian utility regulator named Tom Strickland. It was he who introduced me to electric thermal storage (ETS) heating and electric utility off-peak, nighttime rates. As a result of Tom's visit, I called around the country and learned that no American electric utilities served ETS heating customers, yet most European electric utilities did. I concluded that ETS heating could be a real opportunity for Vermont home heating using electricity available off-peak at night from the two large Vermont private electric utilities: Central Vermont Public Service Corporation and Green Mountain Power. At the time I don't recall either New Hampshire or New York offering off-peak electric rates that were competitive with fossil fuels whereas Massachusetts Electric and Connecticut Light and Power did offer off-peak rates, and a number of ETS systems are installed on their systems.

I needed more information about ETS heating and utility rates before advocating it in Vermont. I applied for and received a grant in the 1970's from the National Science Foundation (NSF) to review ETS technology among European electric utilities. During my review of European ETS heating technology in the 1970's, I discovered it had been heating European homes since the 1950's; more than



Electric thermal storage room units provide a clean, consistent source of heat. Ceramic bricks within the units store vast amounts of heat for long periods of time allowing you to get on-peak performance at off-peak electric rates. (Images: Steffes).

20 years previously! I deliberately became acquainted with a number of European ETS home heating customers, several large European electric utilities and 3 or 4 ETS heating equipment manufacturers. Under the NSF grant I installed German ETS heating units in several Vermont homes served by Green Mountain Power. The results were good. The ETS heaters worked well, customers were warm and comfortable and electric heat was affordable under the nighttime, off-peak electric rate. I recently checked. Nearly all the early ETS heating systems are still operating satisfactorily today; 30 years later.

After leaving the Vermont Public Service Board, I founded Control Electric Corporation and began to import and sell German made AEG, ETS heaters in electric utility service areas where off-peak rates were available; mostly in New England and Nova Scotia. We installed hundreds of ETS heating systems. As I recall, Central Maine Power (CMP) did not offer an off-peak nighttime rate at that time. CMP does today. CMP now offers a residential rate A-LM, load management rate, which is cost-competitive with fossil fuels for home heating.

What is ETS storage heating technology and how much does it cost to heat a home?

ETS heating technology couldn't be simpler. That's why it has been used in homes around the world for more than 50 years. The ETS room heater shown in the picture

contains specially molded magnesite bricks which are heated by electric heating elements to 1200°F during coldest nighttime off-peak hours. The magnesite bricks are specially designed and sized to store the heat energy for release throughout the day during both on and off-peak hours. The box insulation is very well designed and made. Home owners can, if they wish, sit on the heaters! The secret is in the bricks and the sizing of the heater to the heat loss of the area to be heated and the available off-peak electric rate. The amount of off-peak electricity purchased from the electric utility and stored in the bricks is controlled by the outside temperature control; more heat is stored on coldest days. The utility electric meter has a special off-peak register to record the electricity used. The heat is released from the box by radiation and convection from an internal fan controlled either by a thermostat in the heater or on the wall of the room.

The room units are most popular and are designed to the heat loss of the area and the length of the daily charging period. A typical 200-300 ft² bedroom, for example, would use a 240-volt, 2 kW ETS heating unit utilizing an eleven-hour off-peak, night time charging period.

Years ago, I became acquainted with a fellow named Paul Steffes in Dickinson, North Dakota. He eventually founded a ETS heating systems manufacturing company which is now the best known American ETS heating systems manufacturer. As a result of CMP's very attractive off-peak rate, I reestablished contact with Steffes in an attempt to introduce ETS heating systems in Maine.

I started with Efficiency Maine's Resi-



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SOLAR HOT WATER IN THE AGE OF SOLAR ELECTRICITY

Russ Lanoie

For many years, the best way to capture the energy of the sun, other than by inviting it through south-facing windows, was to use it to heat domestic hot water. The advantage to solar hot water is that it does not require very sophisticated technology to capture the energy of the sun and transfer it into water for either residential or commercial use. There are lots of do-it-yourself schemes, such as bread box heaters, that involve almost no technology by simply placing a black-painted water tank inside of an

insulated box glazed with any of several available transparent or translucent glazing materials, sometimes as simple as old storm windows. I had a hose connected to an old water tank with no glazing and fully exposed to the sun for use as an outside shower for summertime. Sometimes the water would almost reach scalding temperatures on warm sunny days.

On the other end of the scale are hot water systems that are used for space heating with storage tanks connected to pumps and controls that circulate hot water through pipes imbedded in a floor or other distribution system. These are generally engineered systems requiring a lot of technology and hardware.

The most common application has been for residential hot water similar to the evacuated tube system shown in the photo or simple "flat plate" collectors that consisted of a glass or other type of glazing covering an insulated box with an "absorber plate" generally made of copper with a series of pipes running through it that connect to a storage tank much like a conventional water heater. I will explain the system that has successfully served my own home since I installed it in 1978.

As my wife and I operated a business we called Alternative Systems in the mid-70s, we built a house that incorporated much of the technology we sold at the time. A Fisher woodstove, still in use, a composting toilet that served for many years, Window Quilts, and a Daystar solar hot water system. The Daystar system came as a complete package, and I sold several of them, some to DIYers and others to customers who had plumbers do the installation. A few were roof mounted, but several were mounted closer to the ground, generally at a 45-degree angle to optimize their ability to capture the sun year-round. A friend mounted his so they could be tilted with the seasons to gain even more sun.

My own system was the subject of a federal monitoring program that consisted of metering hot water and backup electricity and a run time meter on the circulator pump. A researcher visited my house periodically to take readings that showed that our system provided 85% of our hot water even with two little ones in reusable diapers! To optimize the system, we even had a switch that would allow us to turn off the back-up electric power on mornings when the sky was clear to the



The Tin Mountain Renewable Energy Initiative (TIMREI) solar raiser team prepares to install a flat plate solar hot water collector. These plates are heavy and require lots of muscle power. (TIMREI).

west, indicating that the day's washing would be in sun-heated hot water.

The system did require some maintenance, as the water from our municipal system tends to rot out water heaters very quickly. Our biggest expense was to replace the stone-line tank a couple of times until we finally installed a "lifetime" high-performance stainless-steel tank. One replacement control module and one or two circulator pumps were the other plumbing components replaced in over forty years of service, while the original collectors still gather the energy from the sun every times it comes out. The bigger issue is replacing the roof shingles on the south side of our roof, because the collectors will have to be removed and, hopefully replaced with a couple of spare collectors that I have. I've been able to get by with the original shingles by painting them with aluminum paint every few years but has finally run its course. Note that hot water collectors are MUCH heavier than the solar electric PV panels that are beginning to take their place which has been much of the reason for my procrastination.

It is not so much that today's solar electric photovoltaic (PV) panels are so much lighter than solar hot water collectors, as it is their cost has plummeted and their efficiency increased while the cost of electricity is constantly climbing. There are many advantages to PVs over solar hot water systems, not the least is that there are no mechanical components to wear out or a heat transfer fluid to leak or need changing. PVs can be installed almost anywhere within reasonable reach of wiring, either from the roof down or underground from a ground mount system.

PVs, however, are not generally a DIY installation. PV installations usually will need the services of a licensed electrician to make the proper connection into the structure's wiring system in conjunction with the local utility's requirements, at least in grid-tied systems (not off-grid with battery backup).

Russ Lanoie is a long-time solar proponent in New Hampshire's White Mountains and operated his Alternative Systems business in the 1970s—80s selling solar hot water systems, composting toilets and Window Quilts®. He lives in a passive solar home which has had Daystar solar hot water for forty years and 11kW of PVs on his barn since 2015. www.RuralHomeTech.com. ☻

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Getting to Net-Zero Everything: Part 2

Sara Gutterman

This three-part blog series outlines the urgent need to transition to achieve net-zero energy, water, and carbon. This second installment focuses on the threats to global water availability and quality that pose alarming sustainable development challenges.

Water and climate are inextricably linked—climate impacts often manifest as water problems. Warmer temperatures and changing weather patterns affect water sources, placing tremendous stress on water reliability, accessibility, and quality.

Increased precipitation in areas such as the U.S. Midwest, Northeast, and Southeast has led to excessive flooding, erosion, pollution runoff, and damage to surface water and drinking sources.

Extensive drought in the American West has depleted regional water sources and threatened waterways and reservoirs. Rising sea levels and superstorms along the seaboards have compromised coastal aquifers and wetlands.

And that's just a short list of early climate change impacts.

Precious Resource Under Threat

According to the World Resources Institute, two-thirds of the global population will live in water-stressed areas by 2025 as a result of climate change, population growth, rising consumption rates, unsustainable withdrawals, poor infrastructure, and weak local governance.

Three-Step Formula for Resource Savings

As the stress on our water supply continues to increase, comprehensive net-zero strategies are becoming essential—and cost-effective.

The formula for developing a successful management strategy isn't complicated, but it does take forethought. Here are three steps to take:

1. Develop situational awareness and an accurate water assessment, keeping local water risks, regulations, pricing, climate impacts, and solutions in mind.
2. Determine appropriate water objectives and risk mitigation strategies, and identify innovative technologies that can conserve water and safeguard quality.
3. Implement sensors and monitors to offer real-time data, and create an ongoing monitoring and management plan.



Flooding caused by climate change causes water run-off which is contaminating our water. (Adobe Stock Images/Daniel Chetroni)

Humans consume about 9,087 billion cubic meters of water per year, a number that is increasing by nearly two percent annually. The leading offenders are China, India, and the United States, consuming 1,207 billion, 1,182 billion, and 1,053 billion cubic meters respectively, followed by Brazil at 482 billion.

In the United States, population growth is intensifying water demand beyond current capacity limits. This is especially true in the West, where experts predict 100 percent growth in Nevada and Arizona by 2030, 60% in Texas, and upwards of 30% in California and Colorado.

Already experiencing dramatic shortages, some of these high-growth areas are implementing stringent policies, regulations, pricing structures, reporting, and drought contingency plans to manage water availability.

As the need for water becomes increasingly dire, so too is the urgency to address quality. Our dilapidated water-related infrastructure and high levels of water pollution place the United States at a shocking 64th position in the World Health Organization's drinking water quality assessment.

Impact on the Built Environment

While power production and agriculture account for the majority of water use in the United States, managing water in homes and buildings is paramount.

Everyone in the building industry, or in business for that matter, should be paying attention to water, as it is the number one factor prohibiting growth: If there is no water, there will be no permits.

Unfortunately, archaic laws sometimes stand in the way of common-sense solutions. Nonetheless, net-zero water is now an attainable goal through the deployment of

technologies and strategies that address conservation, monitoring, recycling, and environmentally appropriate discharging practices.

States and cities from coast to coast are tackling scarcity through the implementation of stringent policies and pricing mechanisms:

- Santa Fe, NM, for example, has the most rigorous water regulations and highest prices in the country, and correspondingly, the lowest per capita water usage (87 gallons per person per day).
- California has set an aggressive goal to limit use to 55 gallons per person per day by 2050 (indoor use only).
- Other municipalities, like Westminster, Colorado, are integrating data into planning processes, using sophisticated GIS software to overlay water resources and infrastruc-

ture to measure total impact before issuing building permits.

Offset programs proliferate as well, requiring that builders and developers submit net-zero water plans to get project approvals.

Exploding water tap fees have contributed to surging home prices and development delays in markets like Fort Collins, Colorado, where hookup costs have increased by up to 400%.

Bainbridge Island, Washington, and Osceola, Florida, are examples of cities that have placed temporary moratoriums on building due to depleted water sources.

Solutions to Watch

Fortunately, the water sector is experiencing substantial innovation and technological advances that provide solutions for any water management plan.

Low-flow faucets, showerheads, toilets, and appliances are a must-have in the net-zero equation. According to the EPA, modern low-flow faucets reduce flow by 30 percent, saving approximately 700 gallons a year (the equivalent of 40 showers). Low-flow toilets now use 1.28 gallons or less per flush, reducing water use by 54% and saving homeowners as much as \$110 per year.

When it comes to homes, more than 50% of water is used in bathrooms—showers and baths account for approximately 25-30%, and toilets make up about 20-25%. Graywater systems, like Greyter, capture and reuse shower and bath water so that it can be used again for flushing, reducing interior household use by as much as 25%. (greyter.com)

Leak detection and water monitoring systems, like Phyn, also

Cont'd on p.31

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Elm Place, Milton Vt (Carolyn Bates)

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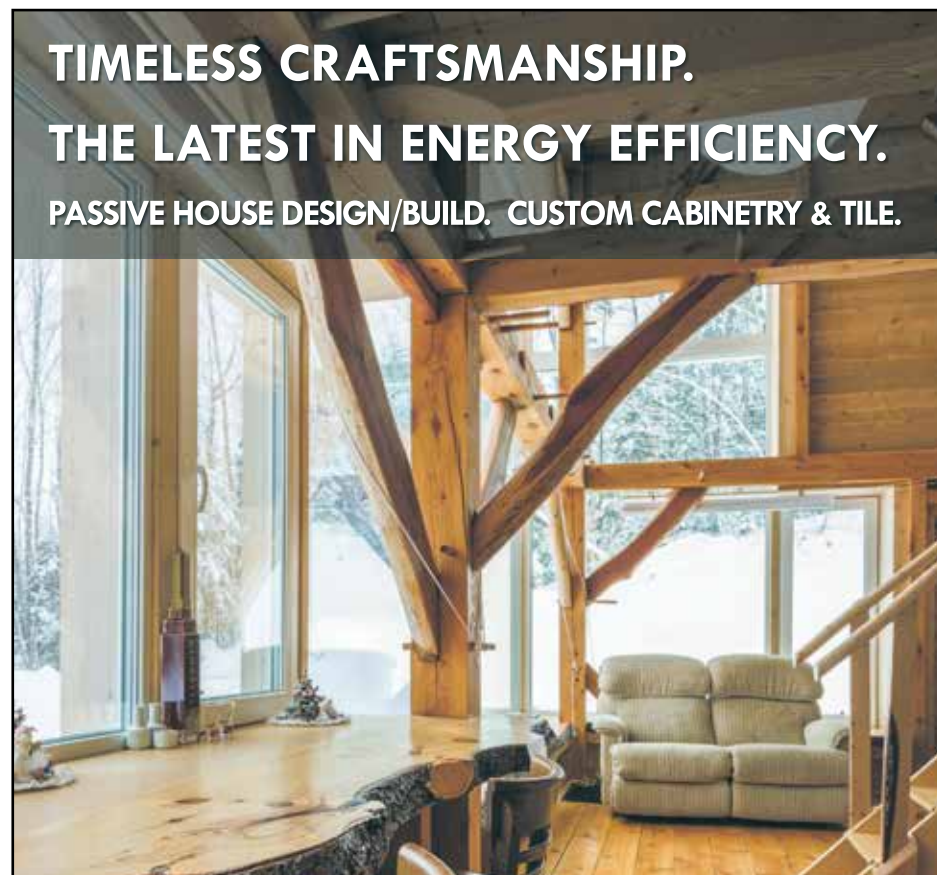
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Drey Ward and Nate Gusakov



The exterior of the house has been restored beyond its original splendor and is blanketed in custom details rendered in wood, metal, glass, copper, and paint. Behind the beauty is a meticulously designed, efficient, healthful home. (Photography by Ryan Bent Photography)

the unique opportunity to work on a Rutland Victorian of approximately 10,000 square feet, transforming it from its original rambling, leaky splendor into an efficient space that could house a new community of residents. The client wanted to respect the home, and its original aesthetic while meeting very specific programmatic requirements so that future residents will feel safe, comfortable, and motivated to live within the beautiful spaces that would be their home.

To that end, SMC worked diligently with Gregor Masefield (of Studio III Architects) and the client to first demolish and preserve and then rebuild. The new space had to meet commercial code requirements while remaining welcoming, efficient, and healthy. This necessitated demolition to the studs (and sometimes beyond, given rot conditions and pest damage) and full renovation, including: new steel beams for structure, a new foundation, wiring, a sprinkler system and plumbing, whole-house ERV ventilation system,

all new windows and doors (U-0.28 or better), and a high-efficiency natural gas boiler that feeds low-temperature baseboard and other radiating features.

The owner's project requirements called for insulation values that meet or exceed VT Building Energy Standard minimums, and the design features full-depth insulation (closed-cell spray foam or cellulose) in the existing wall cavities coupled with R-12 rigid continuous insulation outside the sheathing. With a space as large and complex as this one, creating an excellent air barrier can be a real challenge. SMC workers paid close attention to detail when installing tapes, wraps, and sealants, and their work paid off – the building measured 2.01 ACH50 (a measure of how "tight" or leaky the building is) when their work was done! VT Code simply requires less than 3 ACH50, however the project team wanted to do better, so they also brought in Zone 6 Energy to install AeroBarrier and achieve as tight an envelope as possible. Post AeroBarrier, air

leakage readings fell to 0.46 ACH50 which is a further 77.1% reduction in building-envelope leakage and exceeds the Passive House standard of 0.6 ACH50.

Finish selections reflect the client's vision that the main floor of the house be a modern interpretation that embraces the ornate details of a traditional Victorian. Custom minimalist cabinetry, provided by The Woodworks, shares space with arched openings, elaborate crown molding, herringbone flooring, window seats, and ornate tile. Two small sunrooms offer residents a sunny outside/in or inside/out space to experience a treehouse-like ambiance while protected from the elements. The second level becomes less formal while preserving some of the unique elements original to the home including restored mantles. Each staircase received a unique railing that recalls grand entrances or joyful races to the top. The third floor, nestled against the peaks and valleys of the roof line, evokes an austere aesthetic with playful angles of metal, glass, wood, and light for a feeling of surprise and delight – as if the space is at once integral to and completely apart from the whole.

Interior design finishes, achieved in collaboration with Christine Burdick Design, unify the home with texture, light, comfort, and durability since, after all, this is a commercial space. Two guest rooms and their shared bath with laundry are ADA compliant, so the building is accessible to a wide range of abilities.

So, did we do it? Were we able to meet the client's program while maintaining green integrity? Is it possible to create a new space from an old one and to transform a lovely old rambling Victorian into a healthy, efficient community home? We believe it is, and we believe we did. While we advocate for smaller, efficient spaces in the interest of reducing building costs, materials, impact on the environment, and demand on limited resources, we also recognize that "large" does not always mean wasteful; there is value in upgrading existing housing stock, and it



Embracing grand roots, the modern kitchen, situated among the ornate details of the first level, is designed for collaborative, family style cooking and meals. Careful planning allows chefs and casual window seat observers to be comfortable no matter the climate outside, or the cuisine being prepared inside.



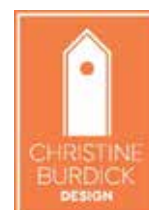
Surrounded by the elements while completely protected from them, this sunroom is an engineering and efficiency marvel. Wool socks not required!

is possible to balance a client's desire for plentiful space and bespoke details with sustainability and efficient choices.

Drey Ward and Nate Gusakov are multi-hatted employees of Silver Maple Construction.

Nate is a talented carpenter and a skilled musician. Drey does not build or play an instrument but can do other things. ♻️

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HIGH-PERFORMING ENERGY DOWN UNDER

Scott A. Sabol

Vermont Technical College's (VTC) Architectural Engineering Technology program and Renewable Energy program both include a senior capstone project, wherein students apply what they have learned in coursework toward solving a problem, capitalizing on an opportunity, or fulfilling some need. The programs both include a focus on energy issues. This year, the two programs have joined forces, challenging students to design a performing arts center in Sydney, Australia. VTC seniors will not only design the building systems, but they will apply renewable energy sources to attempt a net-zero design for the structure.

Their effort is part of the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) 2022 Student Design Competition. The VTC students are entering the "Integrated Sustainable Building Design" option in the competition, where they will develop schematic-level designs of the architectural, mechanical, electrical, lighting, structural, civil, and site systems for a large performing arts center to be located in Sydney, Australia. The building comprises performance areas, office spaces, classrooms, food service, parking, and other uses in three levels, totaling 250,800 square feet (23,300 square meters).

The design should be environmentally friendly and meet energy-efficiency criteria from ASHRAE and others. Students will consider various heating, cooling, and ventilating systems, electrical systems and lighting technologies, and innovative materials, to be energy-efficient with a low carbon footprint (plus creating an effective, aesthetically pleasing look and comfortable conditions for employees and patrons. It is important to note that, the team will attempt to provide sufficient energy from local or on-site



Nathan Mascolino, P.E. (standing), with students (clockwise from left) Cassandra Pelkey, Nicholas Tibbets, James Weishaar, Anna Noble, and Elinore Vranjes. (Photo: Scott A. Sabol)

renewable sources to offset the building's energy use, resulting in net-zero status. An energy production plan may include solar, geothermal, and tidal applications, among others. This marriage of energy-efficient design and renewable energy production highlights the strengths of the two programs at VTC, where Architectural Engineering Technology students bring their capabilities in optimal building system design together with Renewable Energy students' expertise in energy use and production.

The team will spend the beginning of the semester researching Sydney, Australia and the building owner's project requirements. They already have developed a schedule and budget for their design work. After they consider the advantages and disadvantages of various building and energy-production systems, including their sustainability and ability to be integrated effectively, they will select specific systems to pursue further, and perform the calculations and other work necessary to bring all of the building systems designs to a schematic level, along with their energy plan. They will perform an economic analysis of their design, using state of the practice tools such as

heating and cooling load calculators. Their submission to the ASHRAE competition in May will include a video, a technical report documenting their engineering and architectural work, and appropriate design drawings. The team will present its project to the public on VTC's Randolph Center campus, tentatively scheduled for May 6, 2022 (along with another Architectural Engineering Technology team focusing solely on an in-depth structural design of the same building).

The students will be guided by Scott A. Sabol, P.E., who is a full-time faculty member in the Architectural Engineering Technology program, and Nathan Mascolino, P.E., who is an adjunct faculty member


whose primary employer is VEIC, an energy-solutions firm closely tied with Efficiency Vermont.

The idea to combine seniors from the two programs this year came from Professors John Kidder and Dan Costin (who directs the Renewable Energy program). Buildings represent a significant consumer of the world's energy, and energy-efficient design alone will not be sufficient to meet Vermont's goals. The ability to provide sustainable energy for buildings (as well as for other uses) from nontraditional sources is an additional keystone to Vermont's and the world's future. Professor Costin stated, "The 2021 Infrastructure Bill is going to invest billions of dollars in electrical transmission, renewable energy projects, battery storage, and electrical vehicle infrastructure. VTC is prepared to educate and train the workers who will design and build many of these systems. In fact, we have been doing that for years. Our problem in Vermont is that there are not enough workers for these technical jobs, and not enough students getting educated to meet the demand of renewable energy businesses around the state."

More information about the ASHRAE student design competition can be

Vermont Tech (vtc.edu) Renewable Energy B.S. Degree Program Open House April 15

found at www.bit.ly/ASHRAE-comp, and information about the course project, including the public presentations, can be obtained from Professor Sabol (ssabol@vtc.edu). Anyone seeking information about the Renewable Energy program should contact Professor Costin (dcostin@vtc.edu), and should contact Professor Brad Miller, P.E., about the Architectural Engineering Technology program (bmiller@vtc.edu).

Scott A. Sabol, P.E. is a faculty member in the Architectural and Building Engineering Technology Department at Vermont Technical College and lives in Northfield, Vermont. 



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NH ENERGY-EFFICIENCY POLICY PASSES THROUGH THE CRUCIBLE

Sam Evans-Brown

It may not have much else going for it, but 2021 was the year in which we learned that energy efficiency truly can be a winning political issue.

On November 12, the Public Utilities Commission, the body that sets electrical rates, issued a radical decision. They had been deliberating for nearly a year on whether to accept the New Hampshire utilities' latest three-year energy efficiency plan: a consensus approach that had been agreed upon by a broad array of stakeholders. That plan—reflective of the empirical fact that investing in energy efficiency is cost-effective and prudent—included a substantial enhancement of the state's policy ambition when it came to efficiency programs.

The PUC not only rejected the plan, but rejected the entire framework that the state's energy-efficiency policies had been operating under for the previous half decade.

The response was immediate. The utilities shuttered the popular programs that they offer jointly under the banner of NHsaves. The most popular of these programs offers homeowners free energy audits and a 75 percent discount on \$8000 worth of efficiency work, but there are many more, including programs for business owners and low-income households.

Our organization, Clean Energy NH, launched a lawsuit in response seeking an injunction on the order. While that lawsuit failed, we succeeded in stirring the pot. A



The NH State House in Concord. (Wikimedia Commons/ Benedict)

cacophony of voices from across the political spectrum began to speak out against the PUC's decision. At one point, I tried to keep track of all of the news and opinion pieces that were written about the order, but I gave up after the count crested to a few dozen. Even organizations that had not supported the now-rejected three-year efficiency plan—like the Business and Industry Association and Governor Sununu's Department of Energy—wrote letters opposing the decision.

Simultaneously, the legal and political wheels sprung into motion. The same group of stakeholders that had crafted the three-year efficiency plan—which included clean energy advocates, ratepayer advocates, people representing low-income groups, and the utilities—jointly filed an official request that the PUC reconsider its decision. In the legislature, bill language that would right the apple cart was intro-

duced in both chambers.

As of this writing, it seems that it's the legislative solution that will reverse the decision most quickly. The first bill passed the New Hampshire House of Representatives unanimously, and after some tweaks to that will effectively wipe the PUC's decision off the books, did the same in the Senate. The Senate version has the Governor's endorsement, and seems to be on the fast track to become law.

Meanwhile, the Commission itself has dug in its heels. They obdurately rejected the motion for reconsideration and were promptly presented with three separate appeals of their decision to the NH Supreme Court. The silver lining of a decision so extreme is that it unites parties that sometimes are at loggerheads.

So, what to do, going forward? It will likely take at least a year before New Hampshire resumes any sort of progress towards an energy-efficiency policy that truly incentivizes residents to capture all of the wasted energy that makes economic sense for us to capture.

However, what this fight shows is that there is a large group of stakeholders who like energy-efficiency policies: homebuilders, business owners, ratepayer advocates, and even the utilities (assuming they are properly incentivized). Once the dust has settled, those stakeholders need to come back to the table and ask how the Granite State can start putting one foot in front of the other again and make progress on energy efficiency. It's clear we have the political power to make that progress happen.

Sam Evans-Brown is the Executive Director of Clean Energy NH. ☞

Net-Zero Everything – Cont'd from p.28

play a pivotal role, automatically shutting off when leaks are detected and also offering homeowners insights into how they're using water and where savings can be achieved. (phyn.com)

Outdoors, smart irrigation systems, such as Rachio, can create tailored schedules that meet a yard or garden's specific watering needs (based on climate, seasonality, weather, and other factors,) dramatically reducing use and saving up to 50% on bills. Organic lawn care strategies and xeriscaping (planting native and drought-resistant vegetation) can also save water, time, and money. (rachio.com)

Other important innovations include:

- On-demand hot water recirculatory systems that can be turned on with a switch (so that they don't run continuously, using

more energy than needed).

- Rain and roof water harvesting systems with holding tanks and filtration systems so that water can be reused for indoor or outdoor applications.
- Atmospheric generators that pull water out of the air.
- New meters with auto and remote shut-off.
- Groundwater recharge products like permeable pavers.

In combination with innovations, programs are starting to catch on, such as the Water Efficiency Rating Score, or WERS, a performance-based rating for residential water efficiency. (www.wers.us)

Certainly, there is no one-size-fits-all approach for reaching net-zero water, but codes and regulations will play an impor-

tant big role. And, of course, increased consumer awareness will be paramount, requiring a combination of education and incentives to facilitate a behavioral paradigm shift.

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

To learn more about getting to net zero energy, water, and carbon, watch Green Builder Media's webinar at <https://youtu.be/BQEGLogLHeY>. (www.bit.ly/GBM-webinar)

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

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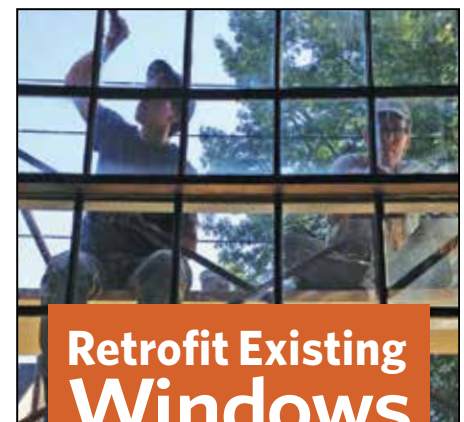
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Children and Climate Change

Cont'd from p. 1

part, though, shows for kids have avoided the topic.

Of course, climate change has become politically charged, but that alone doesn't explain its absence from kid-oriented media. After all, children's programming has handled contentious societal issues before. In the midst of white backlash against racial integration, Mr. Rogers famously invited the local Black police officer to soak his feet in a kiddie pool alongside him on *Mr. Rogers' Neighborhood*. When schools were debating whether to keep autistic students in mainstream classrooms or separate them, *Sesame Street* introduced its first autistic character—and this not long after having added a homeless character.

So why not take on the climate crisis?

One obvious reason is that climate change is frightening. It's hard to portray an existential threat to humanity in a way that is emotionally manageable for children. "For decades, we were showing alarmist imagery of melting ice caps and polar bears that showed climate impacts in remote places," Poirier said. By not recognizing what a complicated, emotional issue it is, "we ended up scaring people to death or overwhelming them so much that it caused everybody to sort of emotionally distance themselves from the issue for a couple of decades."

But the absence of quality youth programming about climate change may actually be exacerbating young people's climate anxiety. "By the time they become teenagers, kids are wondering if there's going to be a world for them to grow up into, if there's even a point in having dreams or going to college," said Jacquelyn Gill, a paleoecologist and an associate professor at the University of Maine's Climate Change Institute. "Now the question is, how do we fight climate despair and climate anxiety among us? Kids are seeing that the grown-ups haven't done anything about climate change. They need

to know that it's still possible to do something, and that's where the big gap is right now."

Fortunately, there are ways to emotionally engage a young audience on the topic of climate change without fearmongering or provoking excessive anxiety. California filmmakers Talleah Bridges McMahon and Jim McMahon demonstrate as much in episode 2 of the Sesame Workshop's four-part docuseries *Through Our Eyes*. The episode, *Uprooted*, is about two US families displaced by climate change. The story follows two sisters, 11 and nine years old, whose family may have to abandon their farm in Iowa in the face of unpredictable weather and a nine-year-old in Texas who is living in a motel because her home was severely damaged by Hurricane Harvey. *Through Our Eyes*, which explores four social problems through the perspectives of children, began streaming on HBO in July.

Bridges McMahon said that they kept hearing people talk about climate change as "an issue that is going to impact us at some point soon" and something "we should really do something about before it happens." But it's happening now, she says. "And people really need to understand that. That was the impetus for us."

Since they were making a film aimed at young audiences with the goal of sparking questions and family conversations—not scaring the bejesus out of viewers—the filmmakers wanted to avoid lingering on how bad things could get and instead focus on how children are adapting, coping, and developing resilience in the face of climate change's effects.

"One thing we grappled with was that climate change is not ending," McMahon said. "It's easier to leave a kid in a good place when you know the problem is behind us, and that's not the case." The challenge of evoking an emotional response in kids who haven't experienced the effects of climate change yet (but who inevitably will) while

not incapacitating them with fear may be what dissuades other filmmakers from tackling the topic. But just because it's hard doesn't mean producers shouldn't do it, Poirier said, and there are ways to do it well.

An April 2020 episode of the animated PBS Kids show *Molly of Denali* is a case in point. The main character, Molly, and her friends trek out to their clubhouse in the Alaskan wilderness only to discover that it has sunk several inches. Molly, an Alaska Native whose heritage includes a mix of Indigenous tribes, is crestfallen. "What happened to our clubhouse?" she asks. She and her friends later learn online that the permafrost under the clubhouse and other buildings is thawing, causing the ground to collapse. Molly's grandfather informs them that this is because the planet is warming but reassures them that people are working on solutions. The kids then set about repairing their clubhouse.

In just 11 minutes, the episode checks all the boxes that Poirier recommends for communicating effectively and appropriately about climate change to a young audience: It shows how the impacts of climate change are relevant to kids' lives, offers a visual representation of the problem, explains science in accessible language, relies on trusted messengers (Molly's grandfather), and avoids fear and helplessness. Most important, it promotes agency. The children learn that they can do something about their clubhouse, even if they can't solve the much-bigger problem of thawing permafrost.

"We want to create some awareness without overwhelming kids or making them afraid," executive producer Dorothea Gillim said. "The message really for kids is, 'Yes, this is happening, but through ingenuity and working together, we can solve problems.'"

Molly of Denali's skillful weaving of climate change themes into kids' programming remains an exception. Fortunately, there are signs that other producers may finally

be turning their attention to the topic. Nickelodeon's Nick News premiered a special episode, "Kids and the Impact of Climate Change," for Earth Day 2021, and the upcoming reboot of *Fraggle Rock* on Apple TV will likely feature climate themes, given its history, said Jamie Donmoyer, an Orlando-based professional puppeteer and producer. The original *Fraggle Rock*—a 1980s show in which underground creatures sought wisdom from a compost pile and referred to humans as "silly creatures"—tackled environmental issues like pollution in amazing ways, Donmoyer said.

Just as it's not too late for humans to take meaningful action to alleviate the effects of climate change, it's not too late for producers to step up and create meaningful media about it for children. "We have to start answering kids' questions," Poirier said, "and we also have to help them feel like they can make a difference . . . because they're the ones who are going to be left with the burden of the climate crisis that we're leaving behind."

This article was originally published by Sierra magazine (<https://bit.ly/Sierra-children-W2021>). 

THE CRITICAL PATH TO ADVANCE EMBODIED CARBON BUILDING CODES

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

The climate crisis requires an all-out effort to reduce energy use and related emissions. Buildings need to be a serious part of this effort. The construction industry alone accounts for 5% of global energy use and 10% of global greenhouse gas emissions. Its emissions come mostly from the manufacture of building materials such as steel, cement, and glass. We need to reduce the carbon embodied in these materials—from their manufacture to their transport, use, and disposal. New building energy codes can be an effective way to accomplish this.

But such codes require a detailed understanding of embodied carbon, and our research reveals critical gaps in knowing how to track and quantify the carbon embodied in building materials, components, and whole-building designs. The largest gap exists at the whole-building level. No consensus exists on how to benchmark embodied carbon in entire buildings because we lack publicly accessible data. In addition, unlike Europe, the United States does not have a standard to assess embodied carbon in the built environment.

Our new study calls on policymakers to work with building and industrial stakeholders to close these knowledge gaps and seize the current window of opportunity to reduce embodied carbon. It notes increased government and consumer interest in low-carbon products as well as a push for new net-zero-energy and net-zero-carbon building codes. It recommends U.S. federal agencies (1) support the development of standards for assessing

embodied carbon in buildings, and (2) work with the private sector on a roadmap to set targets for reducing embodied carbon.

"This study could form the basis for a significant building material contribution to climate change mitigation," says Richard Ottinger, former member of Congress and dean emeritus at Pace University's Elisabeth Haub School of Law. "It augments the pioneering work that ACEEE has done over many years in advocating energy efficiency as the most economic way to help address the global climate threat."

Learn more in the ACEEE study, *Knowledge Infrastructure: The Critical Path to Advance Embodied Carbon Building Codes* (<https://bit.ly/Path-Carbon-Buildings>). This new research, co-authored by Dr. Nora Wang Esram of ACEEE and Ming Hu of the University of Maryland, also appears in a new journal article (<https://bit.ly/Carbon-in-Building-Research>), "The Status of Embodied Carbon in Building Practice and Research in the United States: A Systematic Investigation."

The American Council for an Energy-Efficient Economy (ACEEE), a nonprofit research organization, 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. Learn more at [aceee.org](https://www.aceee.org).

[Editors note]: In an earlier GET article this year there was a link to a wonderful Girl Scout-made youtube video about embodied carbon. It was great, I loved it and everyone I sent it to

got a big kick out of it. We would like to recommend the very fun and informative project of the Badgerland Girlscout council of Wisconsin. You can watch it at: <https://www.youtube.com/watch?v=p6XGYnsK30Y>. 




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New York's Commitment to Electrify Homes

Advocates working to get fossil fuels out of buildings celebrated the bold commitment made January 5th by New York State Governor Hochul to electrify 2 million homes by 2030 and called on her administration to follow through on funding to make it affordable for any building to switch off fossil fuels. The commitment to remove fossil fuel appliances from millions of buildings and replace them with efficient electric appliances is a critical piece of climate action that renewable heating advocates had been pushing the Governor toward for months.

Pollution from heating, cooking, and hot water systems in New York buildings accounts for one-third of greenhouse emissions in the state and harms indoor and outdoor air quality, causing approximately 1,000 premature deaths each year. (www.bit.ly/NY-renewable-heat-1) The State's Climate Action Council, which is tasked with creating a plan to reduce greenhouse gas emissions 40% by 2030 and 85% by 2050, released a draft last week that included the need to electrify approximately 1.8 million homes to meet the 2030 mandate. (www.on.ny.gov/3ALbDS0) Building electrification refers to the process of replacing appliances that burn fossil fuels with efficient electric versions that reduce energy use and will be powered by renewable electricity as the grid becomes greener.

"Too much time has already been lost in the fight against climate change," said Governor Hochul recently in her State of the State address. "Our reliance on fossil fuels must be phased out." She went on to say "New construction in the State will be zero-emission by 2027, and we will build climate-friendly, electric homes and promote electric cars, trucks, and buses."

The Governor's State of the State Book released along with her address provides more detail, committing that the "the State will implement measures to support the creation of 2 million electrified or electrification-ready homes by 2030" with 800,000 being low-to-moderate income households. (www.on.ny.gov/3uf28d6) The Governor also committed to "requiring zero on-site greenhouse gas emissions for new construction no later than 2027," improving building and appliance standards, and "proposing legislation to level the playing field for clean energy alternatives and end the obligation to serve customers with natural gas that currently exists in state law, tailored to maintain affordability for New York's most vulnerable customers."

In October 2021, over 220 organizations signed onto a letter asking the Governor to commit to 2 million all-electric homes by 2030, with half of them being affordable housing in disadvantaged communities. (www.beepony.org/letter) The letter also called for codes that would eliminate fossil fuels in new construction by 2024 and utility regulations that end fossil fuel subsidies provided for new gas hookups. A follow-up letter by over 100 local elected officials reinforced those requests. (www.bit.ly/NY-renewable-heat-3)

The Renewable Heat Now Campaign praised the Governor for naming building electrification as a key priority and for committing to many of the requests from the letter. The group called on her administration to ensure robust and equitable funding for the transition in her forthcoming Executive Budget, move up the dates



New York State Capitol (Flickr/Jim Bowen)

Renewable Heat Now urges the Governor to commit \$1 billion annually for equitable electrification efforts in her upcoming Executive Budget. Half of this funding should come from the New York Green Bank, using at least 50% of its State-authorized capital, or \$500 million to support the greening of affordable housing. The State of the State Book mentions several funding proposals for electrification with little detail.

In addition to focusing on the funds needed in the upcoming State Budget, the Renewable Heat Now campaign is calling on the Governor and legislators to support a package of legislation needed to phase fossil fuels out of buildings. (www.bit.ly/RHN-legislative) This Renewable Heat Now bill package, which includes several of the

policies mentioned by the Governor in the State of the State Book, essentially takes the recommendations coming from the Climate Action Council and provides a legal framework to allow implementation of building electrification to happen at the pace and scale that the climate crisis demands. The All-Electric Building Act (S6843/A8431) requires that no new buildings will heat or run appliances using fossil fuels starting in 2024. This legislation also directs state agencies to identify policies to address affordability. Other components of the bill package address building codes, appliance standards, tax credits, rebates, and changes to public utility law that together serve to shift the status quo from fossil fuel to efficient, affordable electrification. ♻️

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Profile School Is Now 100% Solar-Powered

BETHLEHEM, NEW HAMPSHIRE

George Harvey

We got word in December that the solar array for the Profile Jr.-Sr. High School in Bethlehem, NH had been completed and put into commission, providing power for the school. The array, with a capacity of 344kW, was sized to provide 100% of the school's current electricity demand on an annual basis.

Getting to this point was clearly not a trivial task. It has taken the work of a number of people and organizations over the course of several years. Initial work by the Ammonoosuc Regional Energy Team began in early 2015. Another group that provided guidance was Bethlehem Energy Commission. Melissa Elander, the North Country Energy Specialist of Clean Energy NH provided her assistance. Profile School's Principal, Kerry Sheehan, and Board Chair Kim Koprowski were both heavily involved.

There were certain preliminary actions that were undertaken that facilitated progress. Among these was work that was done by Paul Lehmann, the school's facility manager, who is now retired. He saw to it that the demand for electricity was reduced by switching to LED lights and isolating the computer room heating, ventilation, and air conditioning system, so it could be on a different thermostat than the rest of the school. These actions reflect good practice in general, and they produced a noticeable effect by reducing the school's demand for electricity. They were particularly important for progress on the solar array, however, because as they reduced demand for electricity, they also reduced the size that was needed for the system.

The discussions about a solar array, sustainable energy, and efficiency improvements began in early 2015. By the summer of 2019, enough progress had been made for the school board and administration to begin a formal fact-finding mission. This included having three different solar companies visit the site to submit their proposals about the proposed solar system and ways to finance it.

Progress on the project soon sped up. In December of 2019, the School Board approved the bid from Barrington Power unanimously. With that, the issue became an article at the next Annual Meeting.

A decision on financing the array also had to be made. Discussions focused on two different ways to finance the project. One of these was for the school itself to get financing for the system, own it, and operate it. The advantage for this approach is lower costs in the long run, but the disadvantage was that there would be a substantial initial investment.

A second approach relates to the fact that non-profits including schools and municipalities cannot take advantage of the 26% federal tax credit available for solar installations. But a for-profit organization can finance and own the



Aerial view of the 344kW solar array at The Profile School in Bethlehem, NH, providing 100% of the school's electrical needs. (Jack Bingham of Barrington Power)

array and sell the school the electricity it produces, through a Power Purchase Agreement (PPA) and by making use of the solar tax credits can sell energy to the school at a reduced rate. There is no up-front cost at all to the school, but the school can benefit from an immediate reduction in the cost of electricity. Also, maintenance is not a concern for the school if the array is owned and operated by an investor. This second approach to financing was chosen by the Profile School.

The project was developed by Jack Bingham of Barrington Power and Ted Vansant of New England Commercial Solar Services. Together, they assembled the team of contractors who did the groundwork. Horizons Engineering did the civil engineering, which included setting boundaries and fitting the system properly to avoid any impact on wetlands.

Every post supporting the array's panels had to be located precisely to do this job. Describing the work, Bingham emphasized the importance of precision required, saying "When I say precise, I mean precise. Everything had to be placed perfectly." The work of installing the posts, which in this case are helical piles looking very much like giant wood screws, was done by AP Alternatives. And the contractor who installed all the electric components was Ayer Electric (see their ad on page 11).

In addition to general project development, Barrington Power undertook to finance the system. The Bethlehem Select Board wrote a letter of support for the grant from the USDA Rural Development program for 10% of the cost. The select board was also involved in negotiating a tax rate for the land on which the solar array is constructed. The financing and grant worked to reduce the cost of energy purchased by the school through the PPA.

Profile School's solar array has a lot of advantages for the school. One is that it can be used to teach about energy. But also, it makes costs stable with a system that is flexible and can be scaled as demands change. And, of course, it reduces pollution.

Barrington Power's website is barrington-power.com. New England Commercial Solar Services's website is necsolarservices.com. ☺



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Parking Lot Solar: A Perfect Solution for Schools & more

George Harvey

One great idea for solar systems is to put them up over parking areas. This has lots of advantages, including not just generating electricity, but shading cars and cooling the parking surface. We have a ten-year-old paper on the idea, and found that it still reads as though it were fresh. It is "Making the Grade with Clean Energy: Case Studies of California Solar Schools." It has information and a number of pictures of solar arrays on parking lots at that state's schools, and it may be of interest to readers (www.bit.ly/solar-parking-1).

It occurred to us that the idea may be taken too much for granted, and this could slow down its implementation. It has come up often on our pages. Possibly the most recent article Green Energy Times has had that included the subject of solar canopies for parking lots was "A Net-Zero Multi-Family Community," in the October 2021 edition (bit.ly/solar-parking-2). But we decided to take another look at it.

One thing that readers might ask is how much good it will do to have parking areas covered with solar panels, as a way to address climate change. This can be viewed as a rather simple problem, with two parts. First, we find much land is covered with parking lots. Then we find how much land we would have to cover with solar panels to provide for the current electricity demand of the United States. Please note that the answer to the

the University of Michigan in 2010 (bit.ly/solar-parking-3). According to an article in the *Philadelphia Inquirer*, about a third of the land area of US cities is taken up by parking lots (bit.ly/solar-parking-4). If those data are correct, there are 35,462 square miles of land area taken up by parking in U.S. cities. That area is a little bigger than the southern half of New England (CT, MA, NH, RI, and VT, put together).

Please note, this is just the areas of urban parking lots, and in the case of multi-level parking only takes into account that part that could be exposed to the sun. Another thing we should note here is that these numbers are estimates, and the estimates vary widely, as we shall soon see.

According to the U.S. Department of Energy, the area we would need to cover with solar panels to supply all of the country's current demand for electricity is about 22,000 square miles. This is about 115% of the combined land areas of Vermont and New Hampshire combined (bit.ly/solar-parking-5).

This is where we will compare estimates. It happens that Elon Musk estimated that 10,000 square miles would suffice. An article in *Inverse* said he was right, sort of, but to do the job properly and reliably, we would need far more than that. Data from Delucchi and Jacobson's 100% Solutions Project, found that the U.S. would need to use 0.69% of its total land, or 26,198 square miles (<https://bit.ly/solar-parking-6>).

If we use that last figure, we can see that we could supply the U.S. with its current demand for electricity with solar systems sited on an area about 74% of the size of its urban parking areas. While this will probably not happen for various reasons, it begins to show the advantages of solar canopies over parking areas. There are other reasons to cover parking areas. Asphalt, in the full sun on a hot day, can have a temperature of 140°F fairly easily. That

is hot enough to burn feet and paws; it is hot enough to fry an egg. (How much does that contribute to global warming?)

We would like to remind everyone that the sizes of parking areas that could have solar canopies could range from a single car to as big as a parking lot gets. There are a lot of opportunities here. ☺



Solar panels over a parking lot at the Intel site in Ocotillo, Arizona (Intel Free Press, Flickr, bit.ly/solar-parking-7)

second question assumes that solar is the only primary energy source, and this would mean that electricity is stored for times when the sun is not shining.

Let's look at just urban areas for now. The U.S. has 106,386 square miles of urban areas, according to a fact sheet prepared by the Center for Sustainable Systems at

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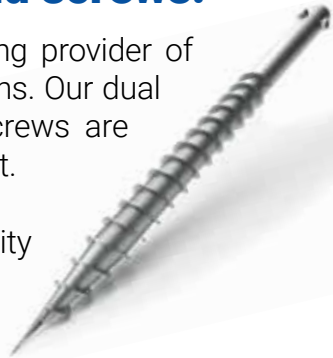


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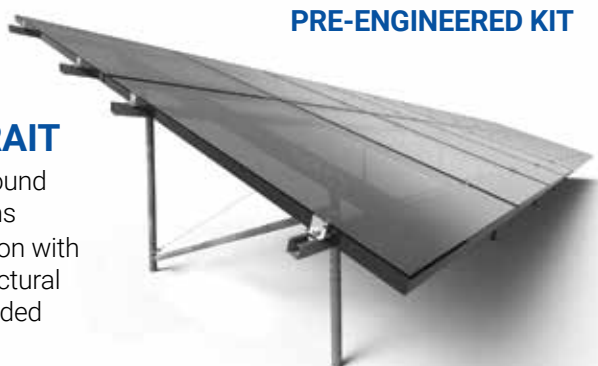
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ELMORE ROOTS' PERMACULTURE KNOW-HOW

Majestic Trees

David Fried

After having some intense dental work one recent morning when it was 21 below zero, I took a walk down the block. The snowy path went through an opening in a tall fence. There it was. One of the biggest trees I have ever seen in Vermont.

It looked like it was part banyan tree and part redwood. Four people could not put their arms around it. Yet it looked like it was holding its arms out to me. I entered its spreading always-green branches and stood by its massive trunk. Reaching up to the sky, whole worlds were leading up, up and up into the morning winter sun.

When someone talks about the old days in kingdoms with kings and queens, it is hard for me to picture. People lining the roads to get a glimpse of the royal carriage going by. Not for me. When I come across an old tall tree is when I feel the majesty of all creation. If only trees were able to rule the kingdom. Silly humans would be relieved of our "control" over nature. We would be guided



(Photo courtesy of David Fried)

by the ancient wisdom of the trees.

My friend Ron Koss just wrote a book called *Parallel* in which he talks about a vision for reversing climate change. We all work together to create a parallel way of thinking and a parallel economy where our purchases and our life is centered on things that are good for the earth. Since companies and countries and famous people aren't making this happen yet, he says that "we earthlings" can

I will note ten things that we can learn from trees.

- Stand tall and don't be afraid to be yourself.
- Be as useful as possible.
- Don't give up, spring will come.
- When your time comes, go back gently into the earth from where you came.
- Learn to sway in the breeze and don't take yourself too seriously.
- Share sunlight, shelter, water and nutrients with others.
- Know your limits. Don't get so tall or full of yourself that you fall over.
- Put your best stuff into the next generation.
- If you don't make so many fruits or nuts or cones this year, there is always next year.
- Remember, we are all a little different from each other, and this is what makes a beautiful forest.

become a united front that can be strong and wise enough for the breakthroughs needed to happen.

I invite the trees to join us. If we listen on a windy day to what they are whispering to us, we will know that they will. In fact, they are reminding us to act now to protect them and all that is dear to them and to us.

David Fried lives among trees and talks to them and hugs them sometimes. He is a tree whisperer. He also grows

and cares for trees at Elmore Roots Nursery and fruit groves. ♻️

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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

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Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home.
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IREC/ Interstate Renewable Energy Council: RE educational info. www.irecusa.org

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

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

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

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

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

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

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

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

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

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org

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

SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

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

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

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

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

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

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

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

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

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

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

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Green, Sheets, and How to Clean Them

Jessie Haas

If you need new sheets and can afford it, invest in organic cotton, linen, bamboo, or eucalyptus tencel. Invest is the right word, so choose what's likely to be the most durable; probably linen, a very strong fiber that gets softer with use. And choose a pleasant, neutral color that you won't grow to hate. If you yearn for new French linen sheets and can't justify spending the money, put them on your holiday wish-list or wedding registry.



Bamboo paper towels are eco-friendly and are reusable. (amazon.com)

If your old sheets are fine, just not as eco-friendly as you'd like, don't buy new sheets. The most eco-efficient bedding is what you own right now. All the ecological costs have already been incurred. Price your dream sheets and use the money you save by not buying them to buy carbon offsets, for a double benefit.

If you do buy new sheets, keep the old ones. There are countless home and garden uses for sheets. Spread them as drop cloths for painting, under a fruit tree before you shake the fruit down, to keep frost from nipping your plants, etc. Check with your local animal shelter as well. They can definitely use towels and may have a need for sheets, too. Or you can cut them up for cleaning rags.

Sometimes you just need a paper towel, though—even though you know you shouldn't be mopping up kitchen spills with the boreal forest. There's good news here: Swedish dish cloths, and their many cellulose

cousins. These are essentially reusable paper towels. Stiff and coarse-feeling when dry, they plump up when dampened, becoming soft, pleasant to handle, and very absorbent. They can be rinsed or laundered over and over before they need to take their turn in the compost pile.

Speaking of the boreal forest, are you flushing it down the toilet? Many of us are, but it's easy to stop. Go to the Natural Resources Defense Council toilet paper scorecard and choose something that's earned an A. Seventh Generation, based in Vermont, makes a good paper with recycled content, or you might try a bamboo paper. There are many to choose from. Does this make a difference? Yes. One tush; small impact. Lots of tushes: Big impact. If talking with your friends about toilet paper feels weird, just share the product information on social media. That's how we find out about things these days.

What are you going to use to clean your sheets and towels? Readers of *Green Energy Times* are very familiar with Vermont Soap Company, which sells an all-purpose castile-based cleaner called Liquid Sunshine which can be used for laundry and all kinds of surface cleaning. The same is true of Vermont Soap's Castile Liquid Soap, which can be used to clean all water-safe surfaces.

Castile soap is made with an olive oil base; Vermont Soap makes an unscented version, and in several scents including lavender, lemongrass, and pine. If you like your first bottle, you can buy a 64-ounce jug



Swedish dishcloths are eco-friendly, reusable, and machine washable. (amazon.com)

to use as a re-fill. At various solutions, which are listed on the bottle, this and other castile soaps can be used to clean almost anything, including laundry, carpets, floors, bathrooms, your car, your dog, and yourself. Using one soap for all these tasks eliminates a lot of packaging, decision-making, and potentially toxic or allergenic chemicals and perfumes. You can frequently find bulk dispensers of liquid castile soap at co-ops and natural food stores.

If you'd rather use a specialized product for laundry, go with a powder, or with dissolvable laundry sheets. When you buy liquid detergent you are paying for water, which is heavy to ship and has a bigger carbon footprint. Laundry sheets, by contrast, weigh a whopping 94% less than liquid laundry detergent and are reported to deliver excellent cleaning results. There are many brands to choose from. Some highly reviewed brands include Tru Earth, Happy Earth, Kind Laundry, and EcoRoots. There's more than just the carbon to consider here. Laundry detergent is nonbiodegradable, and contributes to phosphorous pollution in lakes and rivers.

While you're greening your washroom, consider getting a Guppyfriend wash bag. This product, recommended by Patagonia, traps the microfibers released by fleece and polyester when they are washed. Then you simply remove the fibers with your fingers and put them in the trash, eliminating one source of plastic pollution at its source.

Does one household changing its habits make a big difference? Not really, but a lot will. Nobody will likely comment on your laundry soap, but the cellulose paper towels are odd enough to be noticed and start a conversation. As Katherine Hayhoe, climate scientist and author of the new book *Saving Us* points out, most Americans care about climate change, but we don't talk about it. Talking makes a big difference. For one thing, it might help us see where we all stand on this complex issue. So whip out that weird green paper towel, and if nobody asks about it, pipe up. "You know, these are great, and I've saved so many trees since I started using them—which is great, because trees are so important in the fight against global warming." Or less-hokey words to that effect.

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

Jessie Haas has lived off-grid in Westminster, VT for over 35 years. She is the author of 40 books, including *The Hungry Place*. ♻️



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Larry Plesent

Ingredient *of the Month* CASTILE SOAP

Five Cool Uses for Castile Liquid Soap That You Might Not Know



Known for their mildness, Castile soaps were developed 300 years ago in "La Castilia" region of Spain by artisans that brewed natural liquid soaps from a mixture of olive and coconut oils and herbs. The master soap makers at Vermont Soap follow this tradition to make certified organic soaps that are all-natural and good for your skin. This all-purpose soap can be used for cleaning laundry, dishes, kitchen appliances, bathrooms, carpets, stains, woodwork, floors, and virtually any other water-safe surface. Most important, true castile liquid soaps are safe and effective to use on the hands and body.

Vermont Soap castile liquid soaps are made from renewable and organic vegetable and botanical ingredients including organic saponified (e.g., turned into natural soap) coconut, olive and jojoba oils, essential oils, organic aloe vera and rosemary extract. They are extraordinarily mild, hypoallergenic, USDA Certified Organic, free of artificial colors, fragrances and preservatives, and contain no

sodium lauryl sulfate or other detergents or alcohols. Vermont Soap does not test on animals. Learn more at www.vermont-soap.com

Green Cleaning! - 5 Castile Liquid Soap Tips

Below are some creative tips for using castile liquid soaps. For general cleaning, castile liquid soaps work best in warm or hot water. Use different dilutions for different solutions!

Reusable Cleaning Wipes – While we love the idea and the convenience of disinfecting wipes, we hate the waste and the chemicals used. That's why we like to make our own! Here's how: Mix one cup water and 1/8 cup of your favorite castile liquid soap in a quart mason jar. Try Peppermint Magic, Lemongrass Zen or Sweet Orange for kitchen wipes; Country Lavender, Tea Tree or Pine Woods for bathroom wipes! For the wipes, either buy some cotton dishcloths or use an old t-shirt cut into wipe-sized pieces. Place eight to 10 wipes in the jar and secure the lid. Turn the jar upside-down a couple of times to soak the rags. You're all set! Take a rag out whenever you need to clean up your counter space and simply toss the used wipe into your laundry.

Tub Scrub – Say goodbye to all of those nasty bathtub cleaners! Place 1/2 cup of Tea Tree or Country Lavender castile liquid soap (best options for natural disinfection!) into a medium sized bowl. Slowly add up to 1 1/2 cups baking soda and mix until the consistency of cake frosting. Keep in an airtight three-cup jar

or repurposed squeeze bottle and get to scrubbing! Make sure to rinse your tub thoroughly afterwards. Also works well in sinks and on faucets. If the mixture starts to dry out, add a little water and stir it in to bring your tub scrub back to life.

Carpet Cleaner – You don't need to turn to harsh chemical cleaners to remove tough carpet stains. Place 1/4 cup of your favorite castile liquid soap with 1 cup of water in a blender. Mix until a stiff foam is created. Place mixture on the stain and scrub with a good brush. Wet a towel and wipe the area to remove as much of the soap and dirt as possible. Repeat as needed.

Shaving Soap – Commercial shaving creams are the worst. For smooth, happy skin use this instead! Combine 1/4 cup of your favorite castile liquid soap, one cup of water, two tablespoons of olive, sweet almond, or grapeseed oil (whichever you have on hand or prefer) and place into an empty foamer bottle. Enjoy soft, smooth skin!

Ant Repellent – If you've got ants in your home, your first instinct might be to reach for a can of pesticide to get rid of them. Stop right there! Grab an empty spray bottle and make your own ant repellent! Fill a clean spray bottle 95% of the way with warm water. Add the remaining 5% of the way with your favorite castile liquid soap. Liberally spray wherever you've seen ants (or where you suspect they're coming in) for several days in a row. ♻️

CLOSING THE PLASTIC LOOP – Cont'd from p.18

the website are that it looks as if there may be something to reveal in 2022.

Based in Barre, Filabot has 26 employees including McNaney and his wife. The design team works in Barre and machines are assembled in Rutland. The company has two main types of users, those mostly interested in recycling plastics into filament, and research and development labs and facilities interested in making new polymers. Some clients need filament that doesn't yet exist in a market, with special properties for their application.

Customers include NASA, the Pentagon, LEGO, Xerox, Dow, Intel, and many others. A sister company, Massive Dimension, focuses on larger-scale 3D printing. Filabot also supplies a range of filament-making

and 3D printing supplies. The bigger the object printed, the more plastic is being recycled.

In 2018, McNaney was named to *Forbes Magazine's* "30 Under 30" list in the manufacturing and industry category. Filabot donates filament to the ENable community, which creates prosthetic hands for people in need around the world.

filabot

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

Jessie Haas has lived off-grid for over 35 years. She is the author of 40 books, most recently *The Hungry Place*. ♻️

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