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THE DISRUPTION HAS BEGUN

Batteries are starting to wreck the hopes of fossil fuels

George Harvey

The Hornsdale Power Reserve (HPR) is a big battery in South Australia. At any given instant, it can provide 100 megawatts (MW) of power. It can keep up a discharge of 70 MW for about ten minutes, and 30 MW for another three hours. Its energy storage is rated overall at 130 megawatt hours (MWh).

HPR started making headlines quite a while before it was built. Elon Musk challenged the government of South Australia, saying that Tesla could build the battery in 100 days, or they would get it for free. Of course, they had to open the process for bids, which they got from ninety organizations. But in the end, Tesla won both bid and bet; the battery was built in a little less than a hundred days.

While that is a remarkable story, it is really only the introduction to what may be a historic turning point. The battery, which was installed late in 2017, has now been operating for six months. The numbers on its performance have come in, and those months have been a watershed period.

Before we go further, we should review how electricity is sold in the wholesale market. There are long contracts, some of which lock in prices for decades. For example, the Vermont Yankee nuclear power plant (VY) had a 20-year contract with the state of Vermont to supply power at 3.5 cents per kilowatt hour (kWh). This was a big advantage to the state, which ended up saving a lot of money as prices rose, but, in the end, it may have cost VY more to generate the power than it was paid.

Power is also sold under futures contracts range from year-ahead down to day-ahead. These contracts are for the supply of a specified number of MWh of electricity, at a fixed rate, during a given period. They benefit utilities by offering assurances that the power they need will be there. If a utility or large company can see, for example, that there will be a heat wave starting five days hence, it may buy extra power on the appropriate market to cover the amount it will need to supply customers.

There is the spot market. It operates for times sometimes as short as five minutes. For example, if a baseload power plant suddenly fails during a heat wave, there is loss of generating capacity combined with a high demand, and it must be met, regardless of price.

During really high

Cont'd on p.32

Royal Sustainability... They G.E.T. It!

Randy Bryan with contributions from George Harvey

I watched the news highlights of Prince Harry and Megan (now Duke and Duchess of Sussex), their wedding, and their drive off from the wedding to the first reception in the Jaguar E-type convertible. Beautiful car. Wow! Never even noticed Megan.

Later, I learned that the car was an E-Type Zero, a car Jaguar converted to be a prototype all-electric. I was elegantly surprised. Not the carbon spewing, breakdown prone, beauty it once was. This E-type Zero is powerful, quiet, reliable, and still beautiful. I also recall Prince William and Kate drove away from their wedding in a car powered by bio-fuel. This younger royal generation (and Jaguar) was sending a clear and cleaner message to the world, thus making the moment even more memorable for me. They get it!

This also got me thinking about the leadership that the Royals, the UK, and Europe are providing on environmental issues. They all are clearly ahead of us in recognizing the planet is getting polluted, making plans to clean it up, and forging ahead with those plans.



The Duke and Duchess of Sussex show off their concern for the environment by driving off to their wedding reception in a Jaguar E-Type Concept Zero. This vehicle was originally manufactured in 1968 and has since been converted to electric power. Image: www.lastampa.it

The Royal Family has several long time environment efforts to their credit, from making hydroelectric power for their estates, to remodeling Windsor Castle for greater insulation, switching to LED lighting, installing computer controlled building environment control systems, to plastic reduction efforts and sustainable farming practices. Did you know that Greenpeace and the World Wildlife Fund were started with Royal (Charles) participation?

When the current Queen was young, during the War, she took a job as a truck driver in the ambulance corps, and she learned to do engine repair. It is said that she once bored her mother to distraction over supper with discussions of spark

plugs. Later, when Princess Elizabeth was about to marry, cloth was still subject to rationing. The princess used ration coupons to buy material for her wedding dress. As monarch, Queen Elizabeth II has put some attention on the environment, and she passed that interest on to her family.

Charles, the Prince of Wales, is also the Duke of Cornwall (held in trust), a very large estate with only a small part in the county of that name. He ordered that all the foods it produced to be grown organically. Farmers of the duchy soon found there was a big demand for their products from all over Europe, taking them into a period of prosperity they had not seen for a long

Cont'd on p.24



The Hornsdale Power Reserve.

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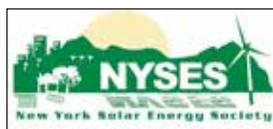
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Our mission is to create Energy Awareness, Understanding and Independence – Socially Responsible Living.

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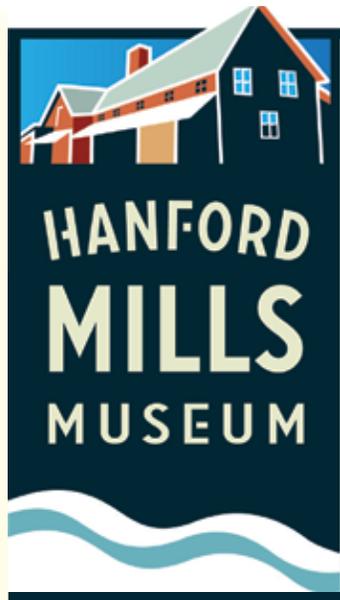
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Thank you for reading G.E.T. Please send your comments & suggestions to: info@greenenergytimes.org

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Derry, NH Town Councilor Inspired by G.E.T.

To the Editor:

Around two and half years ago, I randomly picked up an edition of *Green Energy Times* while waiting for my child to be seen by her pediatrician. We had just had our second child, my first term as a Town Councilor was coming to an end, I had just suffered an election defeat to the Governor's Council, and I was content and ready to retire from politics. Then I saw it. A newspaper about energy efficiency from my home state of Vermont. I began to thumb through the paper until an article about Montpelier becoming a net-zero community caught my eye.

I live in Derry, the fourth largest community of New Hampshire, and we have an extremely high tax rate. The people in our community (like most) aren't willing to give up their services but want a lower tax rate. This is a conundrum that has left me, and many others puzzled. Then it hits me. Why don't we emulate Montpelier? From there, I created the Net-Zero Task Force with a goal of becoming a net-zero community by 2025. I and others worked tirelessly to be able to get the committee off the ground before I left office. The members of the non-partisan council were very supportive and encouraged our efforts. It was that hope of making a real difference that inspired me to run for re-election and see how far we could go.

To date, we've opened a large solar field at our transfer station [editor note: see article on page 10], which may not sound like a huge deal to Vermonters and others in New England, but it is in New Hampshire. We have plans to add on once we prove it makes fiscal sense. We were awarded honorable mention at the 2018 United State Conference of Mayors. I'm so hopeful that in future years we can continue to be creative and smart about how we combat our high tax rate through energy efficiency solutions.

Lastly, I wanted to say thank you. I truly believe that it was your paper that inspired me to remain in office, to create the net-zero committee, and to remain hopeful that we can make a difference in the lives of the 34,000 residents of Derry.

Sincerely,

Josh Bourdon, Derry, NH Town Councilor at Large

A Letter to My Great-Grandchildren Greg Whitchurch



Hello from 2018. This is your great-granddad, Greg. I'm writing to you because I suspect that your parents and grandparents have shown you some of my old photos, and I just want to explain some things about those pictures of me and my cars, me barbecuing hamburgers, sitting around bonfires, our family traveling the world by plane and cruise ship, etc. I realize that you're living in what happened on account of all the waste and pollution which that lifestyle caused. And I know that your life is not as comfortable and your options are not as broad as mine have been. (Ironically though, now that I think about it, the core character traits of my parents and grandparents -- living through the first two World Wars and the Great Depression -- was their determination and the sacrifices they made to make their children's lives better than their own - perhaps you'll try to do the same.)

I know that you're at the end of the 21st century by now, and all of us back here in '18 have a pretty good idea of how bad a shape the planet's in for you folks in the future. I just want to share with you what we were thinking. I can remember back to the late 1900s - when I was about your age. And I remember wondering then what it would've been like to live back in the early 1900s. Horses were just being phased out in favor of electric cars (gas cars were judged too smelly and noisy). Telephones were just becoming available near big cities. Indoor lighting was mostly gas and kerosene, with electricity just starting to enter homes. No TV. No computers. Phonographs were mostly hand-crank. Radios were just becoming affordable and popular. But then technology really took off.

Most of the power for all the advancements we take for granted today came from

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burning hydrocarbons that we pumped out of the ground. It probably seems weird to you, but it's true: we actually dug up the sludge from prehistoric garbage pits of dead plants and animals; shipped it all over the world to be refined into a flammable (explosive!) gas or liquid; and then shipped it right into peoples' homes and businesses to be burned for cooking and heating; pumped it into cars and drove those mobile bombs around while spewing noxious poisons into the air we breathed -- we even burned the stuff to make electricity. (We're well aware that our cars are less than 25% efficient; and that we spend an incredible amount of technology and money to help mitigate all the waste heat, noise, and pollutants from those engines.) I know it must sound crazy to you, but that's what we

Cont'd on p.32

GET OUT OF JAIL FREE CARD: CARBON CAPTURE

James Hansen



There is enough popular misinterpretation of recent news about the cost of carbon capture that I should comment on that.

David Keith has done

some of the most credible work on direct air capture of CO₂, so his recent paper¹ in Joule reporting on the cost of carbon capture deserves attention. Media reports emphasized that these reported costs were lower than costs estimated in a report by the American Physical Society (APS) in 2011. This caused some people to believe that we may be on the way to a "get out of jail free" card, the hope of many that technology will come to the rescue, so we do not need to be so concerned about the mess we are leaving for young people.

Unfortunately, the new news on carbon capture costs provides no support for the notion that we can solve the climate problem without fossil fuel phase-out. On the contrary, the Keith et al. study reinforces our concerns.

Many people failed to notice the matter of units. Keith reports a cost of \$113-232 per ton of CO₂ for plant designs in which the resulting CO₂ is ready for sequestration. The cost per ton of carbon (tC) is higher by the factor 44/12. So the reported cost is \$414-850/tC.

Furthermore, none of the four cases include the cost of carbon storage! According to the 2015 National Academy of Sciences report on CO₂ removal², the costs of geological sequestration are \$37-73/tC. So the total costs for capture plus storage would be \$451-923/tC.

Note that we used the cost range \$113-232/tCO₂ from the Keith paper. They also give a cost range \$94-232/tCO₂, which is what the media picked up on. However, the \$94 case has the CO₂ being used to make a liquid fuel that, when burned, puts the CO₂ back in the air! So there is no negative emission. In fact, that total process would have positive emissions, at least to some degree.

In Young People's Burden³, we were aware that the cost estimates from the APS study were high. Based on many studies referenced in our paper, we chose \$150-350/tC as an optimistic estimate of the potential future cost. The low end of the cost range \$451-923/tC based on Keith et al. is about 30% higher than the upper end of our range!

"Unfortunately, the new news on carbon capture costs provides no support for the notion that we can solve the climate problem without fossil fuel phase-out."

– Dr. James Hansen

In Young People's Burden we show that even our very optimistic cost of carbon capture results in an unbearable debt for young people, if high emissions continue unabated. The new estimates only reaffirm that conclusion. There is no prospect for a Get-Out-of-Jail-Free card.

One of the legal cases⁴ now underway is an effort to block the Trump government from opening up a huge new area of coal mining in Montana. The total coal resources in the basin in question are twice the quantity produced in the entire U.S. since 1949! Burning even a fraction of these resources would leave an astronomical cost for young people, as I show in the linked declaration⁵ I submitted to support the case against expanding that mining. It makes no

An Electric Lawnmower Brigade To Invade Hanover on July 4th

Barbara Callaway

This Fourth of July a group in Hanover, NH will be celebrating electric lawn care as a way to reduce our carbon footprint. **Who knew that a gas-powered mower, using 1.75 gallons per hour, running for 50 hours a season, would produce 1,662.5 pounds of CO₂--almost one ton a year! Over the life of a mower, that is a lot of fuel, emissions, and money saved using electricity. And if you power your mower with renewable electricity, you are helping the Upper Valley move closer to using 100% renewable energy by 2050 which is the goal for Hanover.**

In addition to electric lawn equipment, there are other ways to achieve more energy-efficient lawn care. Reduce the amount of mowing you actually do by reducing the size of your lawn. Plant "pollinator gardens" and edible landscapes instead of grass. Make sure you improve and maintain the efficiency of your current mower, leaf blower, or trim-



Bring your electric lawn mowers for this year's 4th of July parade in Hanover, NH. Courtesy image.

mer by having it serviced yearly. If you are ready to upgrade your equipment, consider going electric. Electric mowers, leaf blowers, and trimmers are quieter, generate zero emissions, and save you money. There are even robomowers, like robot

vacuum cleaners, which are available locally! (See Green-e-Mowers ad on p. 39)

Please join the Hanover Neighborhood Action Group Electric Lawnmower Brigade in the Hanover July 4th parade. Bring your electric lawn mower, electric leaf blower or electric trimmer and march with us. Or just come march with us! The parade begins at 10 AM at Hovey Lane and Lebanon Streets in Hanover. We need "majorettes," "drum majors," children, even musicians and especially electric lawn gear. So please plan to bring your electric lawn care tools or come see what your neighbors are using!

Contact Barbara Callaway at bcallaway65@gmail.com for more information. ♻️

sense to exploit these resources, serving only to enrich a handful of people. Most of the coal would be shipped to the Far East, but, in the end, I do not believe that the United States can escape either the moral or legal obligations from such a willful disregard of the consequences for young people. It makes no sense to approve such expansion of coal mining, and I believe that chances of blocking that expansion are good.

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

Footnotes and Links:

¹ Keith, D.W., et al.: A Process for Capturing CO₂ from the Atmosphere, *Joule*, 2, 1-22, 2018

² National Academy of Sciences: Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration, *Washington, D.C.*, 154 pp., <https://doi.org/10.17226/18805>, 2015

³ Young Peoples Burden: <https://www.earth-syst-dynam.net/8/577/2017/>

⁴ Montana Environmental Information Center v. U.S. Office of Surface Mining and Signal Peak Energy, LLC. Doc. 86

⁵ Hansen Declaration: <http://www.columbia.edu/~jeh1/2018/Hansen.2018.MontanaDeclaration.pdf> ♻️

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What's Happening with Electric Car Incentives?

David Roberts

Plug-in electric vehicles (EVs) are much more efficient than gasoline and diesel-powered vehicles and can be powered by renewably generated electricity. EVs can help clean up transportation, one of our dirtiest energy sectors, and save money on gasoline and maintenance costs for owners. A range of federal and state policies and incentives supporting EV adoption are developing as the numerous benefits of switching from gasoline to electric become clearer.

For many buyers, the upfront cost of an EV remains the most difficult barrier to ownership. Federal, state and electric utility purchase incentives are helping bring down this cost. The most important incentive available to EV buyers is the federal tax credit. This credit was included in the 2008 Energy Improvement and Extension Act passed by Congress and signed into law by George W. Bush. The value of the tax credit is based on the amount of energy stored in the vehicle battery and is capped at \$7,500 per vehicle. All-electric vehicles powered solely by battery power typically get the full \$7,500 amount. A few plug-in hybrids (PHEVs) powered by battery and gasoline power get the maximum, with some lower range PHEVs getting less. The FuelEconomy.gov website has details on the amount of the credit available by model and details on how consumers can claim the credit on a purchase: <https://www.fueleconomy.gov/feg/taxevb.shtml>

About half of EV consumers are leasing, in which case they are not eligible to claim the credit directly, since they do not technically own the EV. In this case, the leasing company will usually pass through all or a portion of the tax credit as a lease incentive to lower the EV lease down payment or monthly payments.

The quantity of federal tax credits available to consumers is capped at 200,000 vehicle sales in the USA by individual automakers. Automakers like Tesla, General Motors and Nissan who were early EV market entrants are likely to approach the 200,000 cap in the next year and begin the sunset steps explained in the diagram below.

Federal Tax Credit Sunset Process

Automaker Reaches 200,000 USA EV Sales

Example: Acme Automaker reaches 200,000 U.S. sales on July 10, 2018 >>

Wait Until Q2 Calendar after Cap Reached

Acme buyers can still claim full credit amount until second quarter after 3rd quarter 2018 >>

Tax Credit Reduced to 50% of Original Amount for 6 Months

Starting January 1, 2019, the tax credit for Acme vehicles is cut in half >>

Tax credit reduced to 25% of Original Amount for Another 6 Months

Starting July 1, 2019, the tax credit for Acme vehicles is further reduce to 25% >>

Tax Credit Completely Phased Out

Acme purchases made after December 31, 2019 not eligible for federal tax credit

According to EV sales estimates reported by InsideEVs.com, Tesla is at 183,801 U.S. sales as of the end of April 2018 and is likely to reach 200,000 in June or July 2018, thus triggering the wind-down of federal tax credit availability. General Motors is next in line with 179,423 U.S. sales and will likely hit the cap around September or October 2018. Nissan is next in line with 118,543 U.S. sales, which could give them another year or more before they reach the cap. Other automakers have more incentives left, but sales could pick up and lead to faster than expected depletion at any point.

Congress could act to extend the availability of the federal EV tax credit to allow more buyers to take advantage of this important incentive, but, given the uncertainties, anyone considering an EV purchase in the next year who is relying on the tax credit to reduce their cost should monitor this issue and possibly move up their purchase date if they can.

Closer to home, many northeast states are offering EV purchase incentives, but a few have run out of funding (or not offered them in the first place). See the table for more details on currently available state incentives.

Vermont is one of the states that doesn't

Cont'd on p.5

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plugged into 240-volt. The LEAF also has an option called ProPILOT Assist, which helps guide the car. It limits the car to a safe distance from the car in front of it and keeps its car centered in its lane. It has an available emergency brake that detects pedestrians.

Eversource materials note the benefits of electric vehicles saying, "The transportation sector is among

Two New England electric utilities are helping their customers buy new Nissan LEAF electric cars. Eversource, which operates in New Hampshire, Massachusetts, and Connecticut, is running its promotion through July 2. The "New Hampshire Electric Co-op (NHEC) will run its promotion in New Hampshire until June 30 but is hoping to extend the offer to the end of the year," said Bill Vecchio from NHEC.

Both promotions allow a customer to buy a Nissan LEAF for a price that is reduced by \$3,000 from MSRP. Combined with a federal tax incentive of \$7,500, along with possible state incentives, this would give some customers the ability to buy new cars that they would otherwise find much more difficult to fit into their budgets.

Both utilities want their customers to note that the manufacturer's suggested retail price (MSRP) for the 2018 LEAF has fallen from what it had been the previous year to below \$29,990. This is \$690 below the MSRP of the 2017 model.

The newer LEAF has a range of up to 150 miles on a single charge. It can be charged at home with 120-volt power but can also be

the top contributors to greenhouse gas emissions. Drivers who make the switch to electric vehicles help reduce carbon dioxide and other harmful emissions, benefiting every New Englander for generations to come."

"We want to help customers have access to the best local deals available on new zero-emission vehicles," said Eversource Senior Vice President and Chief Customer Officer, Penni Conner. "We're excited about the future of electric vehicles and to be doing our part to assist New England in achieving its goal of reducing greenhouse gas emissions to 80% below 1990 levels by 2050. We're committed to saving our customers money and protecting our planet."

Customers of either of these utilities may be able to benefit from the promotions to buy a Nissan LEAF. Those who have accounts with Eversource may learn more by visiting www.eversource.com and be prepared to present an electric bill to participate. NHEC members can learn more about NHEC electric vehicle promotions at www.nhec.com/drive-electric.

Customers can find nearby Nissan dealers at <https://www.nissanusa.com/dealers>. ♻️

ELECTRIC CAR INCENTIVES *Cont'd from p.4*

STATE	ELECTRIC CAR INCENTIVE	WEBSITE
Connecticut	Up to \$3,000	www.ct.gov/deep/CHEAPR
Maine	No consumer incentives available	www.gpcog.org/energy/maine-clean-communities/incentives/
Massachusetts	Up to \$2,500	www.mior-ev.org
New Hampshire	No consumer incentives available	www.granitestatecleancities.nh.gov
New York	Up to \$2,000	https://www.nyscrda.ny.gov/Drive-Clean-Rebate
Vermont	Incentives offered through some electric utility providers	www.driveelectricvt.com/buying-guide/incentives

have a statewide incentive, although many electric utilities do offer a variety of incentives for an EV purchase to their customers. The Vermont Legislature considered several proposals for an EV incentive that would reduce the 6% state purchase and use tax in the 2018 session, but these did not advance this year.

EV industry observers expect EV prices to continue to come down as battery costs are reduced and greater economies of scale are achieved. Many have suggested EVs

will cost the same or less than comparable gasoline-powered vehicles within the next 10 years, after which it will likely be time to revisit the structure and need for any remaining incentive programs.

David Roberts is the Drive Electric Vermont coordinator. He has driven an all-electric Nissan LEAF for the past five years and says, "If you have to drive, drive electric." <http://www.driveelectricvt.com> ♻️



Car Buyers Rank Fuel Economy as a Top Priority

The Trump administration is expected to propose a rollback of greenhouse gas and fuel economy standards, based partly on the notion that Americans are not interested in efficient vehicles. However, a new study shows that American consumers consider fuel efficiency one of a vehicle's most important features — along with price, reliability, and safety.

In fact, they rank fuel economy considerably ahead of premium features and acceleration, according to our survey of 1,883 U.S. drivers who planned to purchase a new or used vehicle within the next ten years. The survey used four strategies to identify the vehicle attributes sought by potential car buyers: an open-ended question, a selection of options, a rank ordering of options, and a discrete choice experiment (looking at choices among hypothetical vehicle options).

The results are clear: Americans want fuel economy.

"Thinking about your next vehicle, which aspects are the most important to you?"

In response to this question, respondents' answers most often clustered around four main themes: safety, reliability, price, and fuel economy.

Read more at <http://bit.ly/aceee-fuel-economy-priority>. ♻️





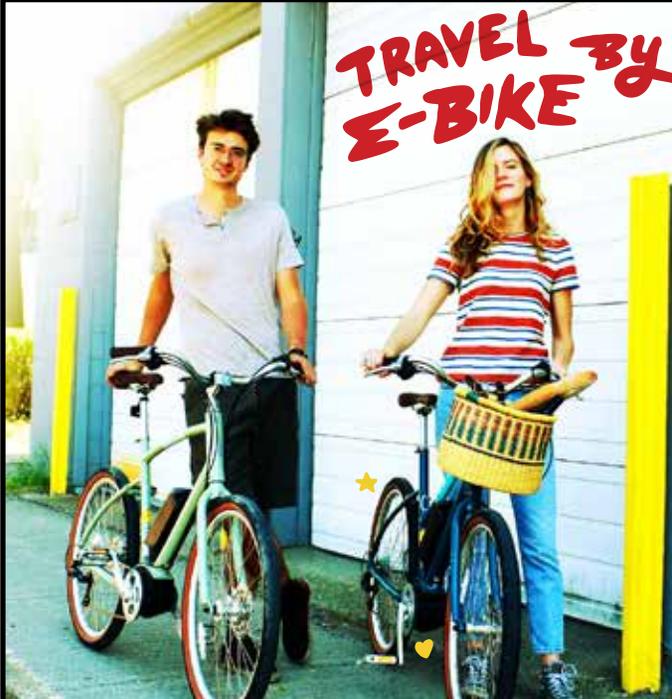


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Transportation emissions are among the worst offenders that add to the rising CO₂ levels in our atmosphere. In recent months we have learned that our efforts have begun to reduce the detrimental air quality counts (NHDES), but as you may have learned from numerous other reports such as the International Panel on Climate Change (IPCC), <http://climatechange2013.org/>, global warming is still advancing faster than expected.

How do we get our emissions down now? By making new commuting choices!

Lots of choices. Smart Commuting is all about knowing your options and planning ahead. There are many choices to get around in New Hampshire and Vermont, The first place to start in Vermont is "Go Vermont" for statewide choices to travel more efficiently. Whether getting around town, commuting to work or school, or planning a day trip, share the driving or ride with someone else to help save our planet and to save approx. \$2,000 annually. The statewide VT site also lists services for commuters, tourist, and shoppers.

In New Hampshire you'll find a similar site at "NH Rideshare" where you can find car-pools, transit routes and schedules, bike and walk trails and links to statewide transportation information.

When carpooling, remember to use the local Park n Ride lots to meet your connections. Start your trip planning at connectingcommuters.org or nh.gov/dot/programs/rideshare/ for statewide choices.

IN NEW HAMPSHIRE

UPPER VALLEY RIDESHARE (UVRS) - Carpool matching, benefits and support for commuters in/out of Upper Valley. 802-295-1824 x208. uppervalleyrideshare.com.

ADVANCE TRANSIT (AT) - Free weekday bus for Lebanon, Hanover, Enfield, Canaan, NH, and Norwich and Hartford, VT. Dartmouth and DHMC Shuttles. ADA & Travel Training Services. 802-295-1824. advancetransit.com

CARROLL COUNTY TRANSIT - Services and connections to Belknap County. 888-997-2020 tccap.org/nct.htm

CITY EXPRESS - Serves Keene. 603-352-8494 hcsservices.org/services/transportation/cityExpress.php

SCS TRANSPORTATION - Services for Sullivan County.. 603-542-9609. SCSHELPS.ORG

CONCORD AREA TRANSIT (CAT) - Serves Concord 603-225-1989 concordareatransit.org

CONTOOCOOK VALLEY TRANSPORTATION (CVTC) - Monadnock Rideshare for the southwest region 877-428-2882 cvtc-nh.org

COOPERATIVE ALLIANCE FOR REGIONAL TRANSPORTATION (CART) - Serving the Chester, Derry, Hampstead, Londonderry, Salem and Windham, limited service to Plaistow. 603-434-3569 cart-rides.org

DARTMOUTH COACH - Services to Boston, Logan Airport and NYC 800-637-0123 dartmouthcoach.com

MANCHESTER TRANSIT AUTHORITY (MTA) - Manchester, with links to Nashua and Concord. 603-623-8801 mtabus.org/services/local-buses

MID-STATE REGIONAL RIDE RESOURCE DIRECTORY - Services elknep-Merrimack Counties, excluding Hooksett and the towns of Deering, Hillsborough and Windsor of Hillsborough County. 603.225.3295 x1201. midstatercc.org

NASHUA TRANSIT SYSTEM (NTS) - Buses and trolleys with bike racks. 603-888-0100 RideBigBlue.com

NH RIDESHARE - Your Source for Transportation Alternatives. nh.gov/dot/programs/rideshare/

IN VERMONT

UPPER VALLEY TRANSPORTATION MANAGEMENT ASSOCIATION (Vital Communities) - Works with UV employers and communities to promote and improve commuting options. 802-291-9100 vitalcommunities.org/transport/index.htm

VERMONT PUBLIC TRANSPORTATION PUBLIC TRANSIT - Lists transit, ferries and more at aot.state.vt.us/PublicTransit/providers.htm

AMTRAK - Long distance train service. Discounts for AAA members and student advance card. (800) 872-7245 amtrak.com

CHITTENDEN COUNTY TRANSPORTATION AUTHORITY - Burlington bus service with links to Montpelier, Middlebury and commuter route to Milton. cctaride.org

CONNECTICUT RIVER TRANSIT - Services in Bellows Falls and Springfield. crtransit.org

GO VERMONT - Offers carpool matching and commuter connections in VT 800-685-7433 connectingcommuters.org

GREEN MOUNTAIN RAILROAD - Day trips from White River, Champlain Valley, Bellows Falls and Rutland. rails-vt.com

GREEN MOUNTAIN TRANSIT AGENCY - Local service in Barre, Montpelier, Grand Isle, Stowe and Lamoille. 802-223-7287 gmtaride.org

GREY HOUND/VERMONT TRANSIT - Long distance bus services. 1-800-231-2222 greyhound.com/

LAKE CHAMPLAIN FERRIES - Transport between New York and Vermont via Lake Champlain. 802-864-9804 ferries.com

MARBLE VALLEY REGIONAL TRANSIT - For Rutland, Killington, rural Manchester, Poulney and Rutland to Bellows Falls. City routes Free on Saturday. 802-773-3244 thebus.com/

RURAL COMMUNITY TRANSPORTATION (RCT) - Buses, vans, and volunteer drivers. Routes via The Jay-Lyn, The Highlander (Newport - Derby Line); The US RT2 Commuter (St. J. to Montpelier) and Free routes to rural areas. 802-748-8170 riderct.org

STAGE COACH - Commuter buses from Randolph and Fairlee to Dartmouth, Local village buses. 800-427-3553 stagecoach-rides.org

HERE'S WHAT WOULD DRIVE EVEN MORE ELECTRIC BUSES INTO U.S. CITIES

Katie Fehrenbacher



Image: evobsession.com

The ski resort community that's home to the Sundance Film Festival — Park City, Utah — is also the birthplace of something far geekier: a new business model for selling electric buses.

The tourist destination was the first community in the U.S. to buy a fleet of electric buses by leasing the batteries that power the buses from Silicon Valley startup Proterra. The city leases the buses' batteries out of its operational funds in the same way that it would have bought fuel for diesel buses. Diesel buses are the standard type of bus that most cities use for moving people around.

The funding innovation is important because it lowered the upfront cost that Park City paid for its new fleet, bringing it closer, or even below, what it would have paid for diesel buses. At the same time, the leasing model also allowed the city to lower its risk around the batteries, which over the past few years have gotten both dramatically lower in cost and somewhat higher in energy density.

Alternative financing has helped other energy technologies break out and it could do so for electric buses, too. The business model of paying for solar power as a service helped solar panels morph from being a niche energy source to becoming a mainstream form of power generation for home owners (although in recent years the trend has shifted back to loans).

Park City isn't the only city experimenting with alternative ways to pay for electric buses. In recent months, New York's MTA — which operates the largest bus fleet in the U.S. — decided to lease five of Proterra's electric buses (both the batteries and the buses) over a three-year period. The Big Apple is looking to experiment with the technology through a pilot program, which could help it make decisions for a larger investment down the road.

The new electric bus financing options could become increasingly popular as more, and smaller, cities review their city transit fleets to figure out ways to afford to buy electric buses. Most of the several hundred electric buses currently driving on the roads in the U.S. were paid for upfront by large cities such as Seattle, Los Angeles, and San Francisco that have set aggressive environmental goals, according to a recent report from Bloomberg New Energy Finance.

But smaller cities just don't have the budgets to make those big upfront payments and often don't have access to the kinds of federal and state grants that have helped pay for early sales of electric buses. Public transportation is "a bit of the haves and the have nots," explained Proterra CEO Ryan Popple.

Popple envisions that one day Proterra's electric buses and batteries eventually will have an even more sophisticated business model that will involve utilities. "The correct business model is that we sell the vehicles to fleet operators and they pay for the battery

pack through the price of electricity," said Popple.

In that scenario a utility such as PG&E would buy the batteries and the city transit agency would rent the batteries from the utility. The math works out because batteries can be used for several years (six to 10 years) in vehicles, but then can continue to be used reliably to charge and discharge plugged into the power grid. "Batteries have residual value," said Popple.

Bloomberg New Energy Finance predicts that third parties eventually will enter the electric bus market to provide financing and leasing options for electric buses for cities and corporations. But the report contends that this "won't happen overnight."

Currently the market for electric buses in the U.S. is still in its early days. Out of 70,000 buses in city fleets in the U.S. just 300 were electric buses as of 2017, according to the Bloomberg New Energy Finance report. That means less than 1 percent of city buses were electrified in the U.S.

But that number is expected to grow by 34 percent per year on average. By 2025, five percent of city bus fleets are expected to be electric.

Growth probably would be a lot faster in the U.S. if there were new kinds of financing for every city, small and large, that wanted it. "We could be moving faster if we financed every battery pack and treated battery packs like fuel or a service," said Popple.

At this point demand isn't the problem for Proterra. The company is constrained by production, and it has sold more than 546 electric buses to cities, organizations and companies.

The U.S. is one of the smaller global markets for electric buses. The big one is, not surprisingly, China.

China has seen 210 percent growth year over year with its electric bus market thanks to aggressive government subsidies, a strong desire to lower air pollution and investments in brand new bus infrastructure. There were close to 400,000 electric buses operating in China in 2017, reports Bloomberg New Energy Finance.

By 2025, close to 1.2 million electric buses will be on the roads in China, predicted the report. Ninety-nine percent of the current global electric bus market is in China and that figure is supposed to remain at 99 percent by 2025. Wow.

The electric bus market is important to watch as it'll likely be a bellwether for the electrification of trucks and other larger vehicles, said Popple, adding: "We want the electric bus to annihilate the diesel bus."

Katie Fehrenbacher is a senior writer and analyst for the transportation sector for GreenBiz.

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WILL YOUR NEXT CAR BE ELECTRIC?

Randy Bryan, Drive Electric NH



Image: cleanenergyresource teams.org

I have talked a lot about the future of electric cars, but there's a lot to be said about the immediate future, too. Namely, should your next car be a plug-in?

A recent national survey of car owners showed interest in buying an electric car increased from 15% in 2017, to 20% in 2018. That's a substantial increase for one year. Still, only about 1% of cars and trucks bought in 2017 were plug-in. Many of us reading Green Energy Times already have electric cars on our radar. A few own or lease them already. But, the big car companies are not pushing electric cars

(except Tesla). So, early adopters have an outsized role to play in providing first-hand knowledge about the car's worthiness. It is word of mouth and shared rides that will win the day.

Electric cars are fun to drive; with full torque from a stop, the quietness, and braking regeneration. Tesla's "Ludicrous Mode" can outrace any combustion car, including the \$250k ones from Ferrari and Porsche. And then there's the financial benefits of driving electric; fuel at half price, one-third maintenance costs, and home charging. Electric vehicle (EV)

owners save about \$600-\$1000/year in fuel and maintenance versus a combustion car.

Lithium battery research has kicked into high gear. Battery prices are halving every four years, and capacity has doubled every six to seven years. By 2025, the typical EV will cost less than the combustion car. For now, there's the federal tax credit to even the cost. And don't forget, EVs are much lower cost to operate. In many cases, total cost breakeven comes within 2-4 years.

The first generation of plug-ins, with 80+ mile EVs, and 20 mile PHEVs (plug-in hybrid), at \$30-\$40k price were great cars. But the limited range and long charge times kept the market small. Luckily, Tesla supplied the EV-envy with their 250-350 mile cars that were fast as lightning for \$100k. But, few could afford this price.

Now, we have the next generation of \$30k to \$40k EVs with 150 to 250-mile range (and 30-50 e-mile PHEVs) with half hour charge times. For EVs, the Chevy Bolt offers 238 mile range, the new Tesla Model 3 offers 210 miles for \$35k to \$40k, while the 2018 Nissan Leaf offers 150 miles for about \$5k less. Tesla alone will make as many Model 3s in 2018 than all electric cars sold in 2016. These EVs make great second cars for most families. Some might even get them as first cars, with occasional rentals. How many of us spend over 98% of our time driving within 150-250 miles per day in one of our family cars? Charge up at night at home, then drive all day, then fill up again the next night, etc. Occasional long trips? You'll

save more on e-fuel and maintenance than you'll spend on a rental car. Or, use the other family car.

For primary cars, plug-in hybrids with 20-50 mile e-range (350+ mile total range) at \$30 to \$45k are a great fit. About 50 to 80% of your driving can be done in all electric mode, then you have the gas engine for longer drives. Great PHEV examples are the Chevy Volt, Toyota Prius, BMW i3re, Chrysler Pacifica, among others. The Pacifica is a large mini-van! Even more style varieties are coming in 2018 and 2019. Look at the compilations of new electric cars at Plug-in America or Sierra Club.

What will your next car purchase be? Here's the Test: Does an available e-car provide the range, style and space you need? Is power available where you park? If an e-car fits, can you afford the price? You'll save thousands over time. If not, you might lease one or get a used e-car. The 80 mile Nissan Leafs and 20 mile Volts are already selling in the \$10 to 15k price range. Lots of choices.

Still not sure? It's lack of public familiarity that holds back EV sales. Consider attending a local Drive Electric event or go to the dealership. When you're ready, drive the future. See you on the road.e

Randy Bryan is one of the co-founders of Drive Electric NH. Randy has been an advocate for electric cars for eight-plus years. His company, ConVerdant Vehicles, has converted vehicles to plug-in hybrids, including his own Prius in 2008, and developed and sold inverters that turn a Prius into an emergency generator. ♻

WHAT IS GOING ON IN WASHINGTON, D.C.?

George Harvey

This was supposed to be a very simple article, providing people with a single link and some information on its usefulness. That link goes to the Environmental Protection Agency's (EPA) Local Government Solar Project Portal (<http://bit.ly/EPA-local-solar-portal>), which is on the EPA's web site. The portal provides resources local governments can use to help get solar power. If you are a local government or plan to be one (or even not interested in being a government), you might look into it.

As I checked the site, however, I found something more interesting that I thought many people would like to know about. At the top of the page, and in fact at the top of all the EPA pages I saw, was this note:

"We've made some changes to EPA.gov. If the information you are looking for is not here, you may be able to find it on the EPA Web Archive or the January 19, 2017 Web Snapshot."

This referred to the information Donald Trump and Scott Pruitt wanted to delete. In the back of my mind, I remembered that it had been made available, but I was not aware of what I found next.

Slightly lower on the home page there is a link to "Environmental Topics." That



Jim Bridenstine being sworn in at NASA. Photo: Bill Ingalls, NASA.

page has a link to the "Air" section, which has, in turn, a link to a page called "Transportation and Climate Change." (<http://bit.ly/EPA-climate-change>) There, we find this statement:

"Burning fossil fuels like gasoline and diesel releases carbon dioxide, a greenhouse gas, into the atmosphere. The buildup of carbon dioxide (CO2) and other greenhouse gases like methane (CH4), nitrous oxide (N2O), and hydrofluorocarbons (HFCs) is causing the Earth's atmosphere to warm, resulting in changes to the climate we are already

starting to see today."

This statement, hardly what I would expect from Scott Pruitt's EPA, brought some news I have seen to mind. One item was reported in Bloomberg on May 11, 2018. (<http://bit.ly/senators-and-tariffs>) According to that article, eight Republican senators had asked that tariffs on solar panels for utility-scale solar projects be dropped.

Another article, which appeared a few days later, was even more surprising. Jim Bridenstine, as a Republican member of the U.S. House of Representatives from Oklahoma, had delivered speeches denying climate change. Though Bridenstine

had no background in science, Donald Trump appointed him to be the head of NASA, and his position was confirmed on April 19, 2018. After spending about four weeks there, he seems to have had a change of heart on climate change, as reported by The Atlantic. (<http://bit.ly/Atlantic-Bridenstine>) At a "town hall" meeting at NASA headquarters, he made this statement:

"I don't deny that consensus that the climate is changing. In fact, I fully believe and know that the climate is changing. I also know that we human beings

are contributing to it in a major way. Carbon dioxide is a greenhouse gas. We're putting it into the atmosphere in volumes that we haven't seen, and that greenhouse gas is warming the planet. That is absolutely happening, and we are responsible for it."

Something may be changing besides the climate.



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Catamount Solar — SUSTAINABLE, SHARING, STABLE, SENSIBLE

Evan Lawrence



The staff of Catamount Solar's worker-owner company. Photo: Bob Eddy.

Catamount Solar has the distinction of being the only Vermont solar design and installation company that's set up as a worker-owned cooperative.

Kevin McCollister, Dan Kinney, and Howie Michaelson, formerly of groSolar, founded Catamount in 2011. "We looked around and realized there was an opportunity for a new solar company," said McCollister, Catamount's managing member. "We wanted to establish a company not completely focused on growth, but more on stability and sustainability and that had an economic fairness aspect."

The time was "not too long after the U.S. financial system almost melted down," McCollister recalled. A few years earlier, hundreds of thousands of people had lost jobs as companies shed employees or closed. Catamount Solar's partners thought there must be a better way to organize a business and wanted a business structure "that would work better for us and our customers," McCollister said. They chose to become a worker-owned cooperative.

Catamount's employees are paid under a rate structure depending on their job, but they also share in company profits at the end of the year. To become worker-owners, new hires work for three years and buy into the company, so they "truly have some skin in the game," McCollister said. "There's incredible pride among our employees." As owners, "they understand the need to get it right the first time." New employees "see how other work-

ers do their jobs, and if they're going to succeed, they get it."

Worker-owners have a say in what happens at the company. "Collaborative decisions are often better," McCollister said. Also, a cooperative has a built-in succession strategy. "It's not just (the founders') company," he said. "The founders won't cash out and sell to out of state owners. The people who came after us (in Catamount Solar) will

take over when we retire."

Customers benefit too. "We've seen quite a bit of attrition in the Vermont solar world," McCollister said. When solar companies go out of business, their customers have to find another company to repair and maintain the systems on which they rely. Catamount Solar is in Vermont to stay.

As part of its commitment to the larger community, Catamount Solar donates 5% of its annual profit to Vermont non-profits. As an ownership perk, employee owners each are able to designate \$1000 contribution annually. Remaining charitable funds are distributed by a committee of employee owners. Past recipients have included the Orange County 4-H club, the Randolph Area Food Shelf, and the Catamount Pipe Band.

Catamount will install photovoltaic systems for "the smallest off-grid cabins to big 500kW solar fields" in Vermont and western New Hampshire, McCollister said. Due to Vermont's regulatory structure, 500kW is the largest capacity allowed for net-metered systems, he said.

Catamount Solar's designers and technicians can collaborate with architects and contractors on new construction, integrating the photovoltaic system with the building's structure and other systems, McCollister said. "Several architects and contractors work exclusively with us," he said.

One memorable job was a commercial installation for Copeland Furniture on a brownfield in Bradford, Vt. The ground-mounted panels had to be arranged to

maintain access to active monitoring wells. "That was a great success story," McCollister said. The project made good use of blighted land, and "it won't be challenging to decommission in 20 to 30 years or at the end of their life, at which time the brown-field remediation work might be complete enough to allow for another type of use."

A 100kW photovoltaic system for the McKnight Farm in East Montpelier also took advantage of idle land. The organic dairy farm needed to keep a 50-foot buffer between its cropland and its neighbors, McCollister said. "About 75% of the farm's PV system is in that buffer zone, which otherwise he can't use."

Catamount will put in battery systems so homeowners can store their solar electric-

ity. PV systems are good power sources for cold climate heat pumps. "Combining heat pumps with solar provides a carbon-free strategy for home heating," McCollister said. The company is happy to install Level 2 electric vehicle chargers on new builds. "EVs and solar go very well together," he said. "An EV charger is an easy thing to add to a project. It's a new direction that we'll see more of."

Climate change "is a great opportunity for us to do something practical to reduce the use of fossil

Cont'd on p.11

Many thanks to our sponsor:



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

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Solar Power Takes Off at Lebanon's Granite Air Center



Granite Air Center, with a new solar array on the hangar roof. Courtesy photo.

Lebanon, NH – Granite Air Center, Inc. announced that it has partnered with Norwich Solar Technologies of White River Junction, Vermont, to install a 218.1-kilowatt DC, net-metered photovoltaic (PV) system on the main hangar rooftop at their facility. It is the largest solar array in the city of Lebanon to date. Completed in early May 2018, the solar array will provide Granite Air long-term energy cost reduction and stability through the integration of clean, renewable solar electricity.

Granite Air Center is Lebanon Airport's fixed base operator (FBO). The FBO provides refueling, repair, maintenance, short and long-term hangar storage, and other services to general aviation and commercial aircraft.

Jason Archambeault, co-owner and chief operations officer of Granite Air Center, said the solar PV project is important to them for a number of reasons. "We love the idea that we can offset a large part of our carbon footprint through solar," said Archambeault. "We believe following socially responsible business practices is just the right thing to do. And using a local solar company to do the work also supports local jobs."

The recent increase in solar projects at America's airports can be credited to a Federal Aviation Administration program. The Airport Environmental Program is intended to reduce emissions, as well benefit operators with significant savings in an industry with historically large operational and environmental costs.

Airports are particularly attractive for solar installations, not only because of the abundance of structurally sound roof space on hangars and terminals, but also because they typically have unobstructed, unshaded solar exposure. Due to their nearly round-the-clock operation, even smaller regional airports can have significant electricity bills.

Granite Air's solar PV array is expected to meet nearly all of their electricity needs.

"As solar power continues to prove its economic and environmental value, airports in the U.S. are an obvious choice for PV installations. The scale of airport solar projects continues to grow, because there is considerable untapped energy potential at the nation's roughly 13,000 airports and airfields," said Bob Lewis, Vice President of Sales and Marketing at Norwich Solar Technologies.

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Greg Soho, Granite Air Center co-owner and chief financial officer, added that he came to the realization after a presentation on the project with Norwich Solar. "The decision to move forward with the project was pretty easy, in addition to the environmental benefits of producing renewable solar energy, we are able to stabilize our long-term electricity costs." With a federal investment tax credit of 30% and a New Hampshire rebate, more than half of the system cost will be offset by incentives, not including the generous accelerated depreciation allowed for renewable energy projects." Soho added, "With the incentives available to us this is a very viable project."

In addition to long-term energy savings, the solar array will provide the environmental benefits of offsetting the equivalent of 5,554,000 lbs. of CO₂, the equivalent of 11,341,000 miles driven by automobile or 268,000 gallons of jet fuel burned, over its warranted 25-year lifespan.

Norwich Solar Technologies provided complete services for the project including permitting, site analysis, engineering, procurement, construction and long-term maintenance of the system. The project also required an FAA review, which Norwich Solar facilitated, ensuring that the array does not obstruct visibility from the tower or cause a glare hazard for pilots.

Granite Air Center's website is <http://www.graniteair.com>.

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DERRY AND LONDONDERRY, NEW HAMPSHIRE RECYCLE "WASTE" LANDS FOR GROUNDBREAKING SOLAR FARMS

Derry Cuts the Ribbon on Transfer Station Solar Trackers, while Londonderry Signs Lease for Historic Solar Project at Condemned Former Landfill

Chris Gillespie



The ribbon cutting event for Derry's solar farm took place May 15, 2018. (L-R) Erik Shifflett, Granite State Solar (GSS) co-owner, with Derry Town Councilor Josh Bourdon, Mike Fowler, Derry Director of Public Works and Alan Gauntt, GSS co-owner. Courtesy photo.

inspire other towns to embrace renewable forms of energy as plausible and cost-effective measures. Above all, Derry officials are looking forward to the financial benefits the solar trackers will bring to the town. The project was dedicated on May 15, 2018.

"We all want to see our taxes reduced, so going solar was a non-partisan no-brainer," said Town Councilor and Vice Chairman of Derry's Net-Zero Task Force, Joshua Bourdon. "These trackers are going to save Derry residents hundreds of thousands of dollars."

After an anticipated \$58,000 rebate, the transfer station solar project will have a gross cost of approximately \$220,000. Over its twenty-five year warranty, the trackers will help the town of Derry save about \$25,000 in electricity costs per year, equaling \$500,000 over the course of the solar farm's lifespan. These savings will be passed on to Derry taxpayers.

In addition to helping taxpayers, the solar trackers will help move Derry's Net-Zero Task Force closer to their goal of reaching net-zero status for the town by 2025. Previously, the Task Force has overseen the upgrading of Derry's town buildings' windows, doors, insulating material and light-

ing fixtures in order to maximize energy efficiency. These measures, according to Bourdon, are just the beginning for Derry.

"The trackers at the transfer station are one small step. We will be coming back with a much, much larger project," said Bourdon. "Our goal is to have the largest municipality-owned solar farm in the state."

Meanwhile, in Londonderry, town officials recently signed a lease agreement with Granite Apollo to develop a 10MW AC solar project at the Auburn Road Landfill Superfund Site.

Located on approximately 200 acres of town-owned land off of Auburn Road, the project, named Superfund Solar, is projected to generate more than \$200,000 in annual revenue for the town over the course of the twenty-five year lease (with an option to extend it to forty years).



Granite Apollo is set to negotiate a power purchase agreement for sale of the power within ISO New England, the organization that oversees the region's wholesale electricity marketplace.

"The Superfund Solar Project will generate clean, renewable power at competitive prices to help Granite Staters save money on their power bills," said Chris Stewart, founder and principal of Granite Apollo, in a recent press release. "Well-sited utility scale solar is a key part of New England's energy future, and we are excited to work with the town of Londonderry on this project."

Cont'd on p.11

Two neighboring towns in southern New Hampshire are revitalizing pieces of town-owned land historically used for waste management by building solar PV arrays on the properties.

In Derry, ten ground-mounted tracking devices have been built by Granite State Solar at the town's waste and recycling transfer station. Each tracking device holds twenty-four 360-watt solar panels. The array will yield 155,000 kilowatt hours per year and will power the transfer station as well as the nearby town wastewater facility.

Town officials hope the solar farm, which is visible from Interstate 93, will



Top rt: Once considered useless, the Auburn Road Landfill Superfund Site in Londonderry, NH will soon be home to the largest solar array in the Granite State. Above: ten ground-mounted tracking devices in Derry, NH at the town's waste and recycling transfer station. Photos by Chris Gillespie.

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GROUNDBREAKING *Cont'd from p.10*

For decades, the Auburn Road Landfill property was considered unusable by government agencies since being used as a town dump in the 1960s, when residents buried over a thousand drums of chemical waste, discarded tires and solid waste into the land. Nearly sixty years later, Granite Apollo's 10MW array will become the largest solar array in the state of New Hampshire and generate enough electricity to power roughly 2,500 homes.

In a manner that's similar to their neighbors in Derry, Londonderry officials hope that Superfund Solar will spur economic development in southern New Hampshire while simultaneously decreasing regional carbon emissions.

"This is a great opportunity for the town of Londonderry," said Londonderry Town Manager Kevin Smith. "We are very happy to be working with Granite Apollo on what will be one of New Hampshire's largest

solar array projects to date. Over the last few years, Londonderry has been a leading municipality in promoting clean and efficient energy initiatives, with this latest solar project being another example of our commitment to New Hampshire's clean tech future."

Given that the Derry-Londonderry area is estimated to be the fastest growing area in the state by the U.S. Census, it seems that solar energy is poised to play a large role in the continued development of southern New Hampshire's economy and infrastructure.

Chris Gillespie is a contributing writer for G.E.T. He can be reached at chris@greenenergytimes.org. ♻️

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Catamount Solar *Cont'd from p.8*



A 100kW photovoltaic system for the McKnight's organic Farm in East Montpelier, VT. Courtesy photo.

fuel," McCollister said. "Our national government has unfortunately taken steps in the opposite direction. People in Vermont and the Vermont government understand that's not really progress. We're taking the matter into our own hands."

The employee-owners at Catamount Solar "want to keep building solar in Vermont," McCollister said. "It's gotten a little harder the way the rules have changed, but Vermonters want to do the right thing. We want to maintain our business and treat our customers right. Solar power is the way of the future. It's clean, renewable power." ♻️



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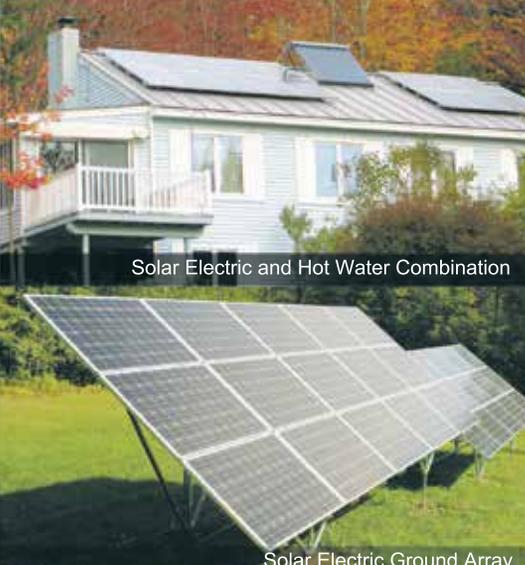
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How Lithium Iron Phosphate Batteries are Easier on the Environment

Danielle Ferguson

Lithium iron phosphate (LiFePO₄) batteries have many characteristics that make them superior to other battery technologies. They are lightweight and versatile. They have a long lifespan and a fast recharge rate. They can also withstand cold, heat, collision, and mishandling during charging and discharging without risk of combustion.

But are lithium iron phosphate batteries environmentally friendly?

Manufacturing batteries does require energy and resources. But lithium iron phosphate batteries have several advantages over other technologies in terms of resource consumption and safety. Let's take a look at a few of the environmental benefits of using LiFePO₄ battery technology.

Enabling Electricity Storage in Renewable Energy Systems

When it comes to generating electricity with minimal carbon emissions, it's hard to beat wind and solar power. Solar power costs have dropped more than 70% since 2010. But renewables such as wind and solar do not provide electricity constantly, which means practical off-grid or backup battery storage is needed. LiFePO₄ batteries are ideal for energy storage with several practical and economic advantages over lead-acid batteries or other lithium battery technologies, including:

- Maintenance-free operation, with no need to monitor or top up water levels.
- Partial state of charge (PSOC) tolerant, which means if operated in PSOC, there is no damage (this is one of the leading causes of early failure of lead-acid batteries).
- A much longer life span compared to lead-acid batteries (up to 10x longer), and a lower overall cost of ownership.

- A 25%-50% higher capacity than lead-acid batteries, with full power available throughout discharge.
- Fast recharge times and a 99% efficient recharge process, which means less wasted electricity.
- A low rate of self-discharge, which means a long shelf life, up to a year, between charges.

And perhaps most importantly, LiFePO₄ batteries are inherently stable and non-combustible, and they are free from dangerous out-gassing, fumes, and leaks.

A Recyclable Alternative

The disposal or recycling of batteries remains a key environmental issue. More than three million tons of lead-acid batteries are discarded every year. Some are safely recycled to recover the lead and other materials. But many end up in landfills, especially in developing countries, where toxins can cause fires, explosions and poison food and water supplies for generations.

With electrodes made of non-toxic materials, lithium iron phosphate batteries pose far less risk to the environment than lead-acid batteries. They can also be recycled to recover the materials used in their electrodes, wiring, and casings. Some of this material can be used in new lithium batteries. Even now, buyers can choose to buy LiFePO₄ batteries made from recycled materials.

The long lifetimes of lithium batteries used for energy storage and transportation mean that many are still in use, so recycling processes are still in their infancy.

Inherently Stable and Non-Toxic Chemistry

How do LiFePO₄ batteries stack up against



Three 48 Volt LiFePO₄ RELiON batteries: 100, 200, and 300 Ah.

other types of lithium batteries in terms of environmental friendliness?

Lithium itself is not toxic, and it does not bio-accumulate like lead or other heavy metals. But most lithium battery chemistries use oxides of nickel, cobalt, or manganese in their electrodes. Estimates suggest it takes 50% more energy to produce these materials compared to the electrodes in lithium iron phosphate batteries. A 2013 report by the EPA revealed Li-based batteries based on nickel or cobalt have the highest environmental impact including resource depletion, ecological toxicity, and human health impacts, all almost entirely due to the production and processing of nickel and cobalt.

LiFePO₄ batteries, by contrast, have big advantages over other lithium chemistries:

- They use no rare earths or toxic metals and employ commonly available materials including copper, iron, and graphite;
- Less energy is consumed in mining and processing of materials;
- Phosphate salts are also less soluble than

metal oxides, so they are less likely to leach into the environment if the battery is improperly discarded; and

- LiFePO₄ batteries are chemically stable against combustion and rupture under nearly all operating and storage conditions.
- An Environmentally-Friendly Battery Technology
- While it does take resources to produce practical and efficient batteries, not all battery technologies are created equal.
- Lithium iron phosphate batteries not only have superior operating characteristics compared to lead-acid batteries, they're also far less toxic to produce and recycle.
- Compared to other lithium battery technologies, LiFePO₄ batteries use more abundant and non-toxic materials that can be produced with less energy.

And most promising of all, the performance and safety of LiFePO₄ batteries make them a superior choice for electricity storage in zero-emission renewable electricity wind and solar power systems.

We're all concerned about the environment, and we strive to do our part to reduce pollution and resource consumption. When it comes to choosing a battery technology, lithium iron phosphate batteries are an excellent choice for renewable energy storage and for minimizing the consequences of resource extraction. As lithium iron phosphate batteries become more widely adopted, the benefits of this technology for the environment will continue to grow.

Danielle Ferguson can be reached at dferguson@reliionbattery.com. Learn more about RELiON LiFePO₄ batteries at reliionbattery.com. 

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NY-Sun's Solarize Initiative: Getting the Job Done

New York Governor Andrew Cuomo announced that 2,439 solar projects have been installed or are in development in communities throughout New York. These projects are part of locally-organized campaigns supported through the NY-Sun Solarize Initiative. Solarize is a vital component of Governor Cuomo's Clean Energy Standard, which requires that half of New York's electricity come from renewable sources by 2030.

Launched in 2014, the NY-Sun initiative has supported 81 Solarize campaigns through the first three rounds of funding, which include the 2,439 local projects

statewide. In this latest round, and for the first time, community solar was included as a component eligible for support, which resulted in 175 residents and small businesses in the southern tier and mid-Hudson Valley regions signing up.

New York State Energy Research and Development Authority (NYSERDA) has provided nearly \$830,000 in technical and marketing support through the first three rounds of Solarize. Projects in all rounds (including community solar subscriptions) total 19.47 megawatts of installed solar - the equivalent of powering 3,241 homes per year.

Cont'd on p.29



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Sonnen Batteries

– A Unique Lithium Option for Grid-tied Backup Power

George Harvey

In a way, the sonnen battery story started in 1997, with a decision by the roughly 2,500 people of Wildpoldsried, a town in Bavaria, Germany, to produce their own renewable power. Organizations and individuals in the community began to install renewable generating plants based on all sorts of technologies. They included solar photovoltaic (PV) systems, wind turbines, bio-digesters, and small hydro projects. They supplied electricity, gas, and heat to households, businesses, and municipal offices.

The experiment was so successful that within fourteen years, Wildpoldsried was producing over 320% of the energy it needed, and exporting several million euros worth of electricity each year. Since the people of the town had made the investments into renewable energy, they found themselves entering a new era of prosperity.

In 2010, two people, Christoph Ostermann and Torsten Stiefenhofer, founded a new business in Wildpoldsried to make batteries. Sonnen GmbH makes batteries. (Nouns are always capitalized in German. Since the name is purposely un-capitalized, and therefore not a noun, we can assume it means “solar.” I will capitalize it at the beginnings of sentences.)

Sonnen brought their batteries to market first in Europe, and began selling them in markets of the United States and Australia shortly before Hurricane Maria struck Puerto Rico. The company helped after the disaster, installing battery sup-

port for a number of microgrids. It did this especially in the island’s interior and other areas seemed to be ignored by the federal government and some large corporations.

We should focus, however on the sonnen battery itself. Because it is based on LiFePO4 chemistry, the sonnen battery is somewhat like the RELiON batteries covered in the April issue of Green Energy Times article, “RELiON Lithium Batteries.” There are some important differences however. To learn more about sonnen’s batteries, we contacted Erik Shifflett, who runs Granite State Solar, of Bow, New Hampshire, together with partner Alan Gauntt, to install systems in New Hampshire and Vermont.

Granite State Solar is a company with some pride in its expertise and abilities. The systems it installs are designed to provide the best engineered solutions to meet each customer’s individual needs. For example, it has partnered with AllEarth Renewables so it can install tracking systems where that is the best option. It does not subcontract work, and instead provides year-round employment to about thirty employees.

Shifflett said that a couple years back he set out on a search for the best possible batteries for customers. His own solar company was growing, but the entire battery business was evolving rapidly, and he spent a lot of time and energy assessing the various offerings. He looked at the Tesla battery, of course, and such others as the Aquion battery, which was based

on a nearly non-toxic chemistry.

What he found was that sonnen’s batteries stood out in ways that made it unique. Among these is the battery’s interesting designs that tie it to grid electricity and solar panels. The sonnen battery is the first battery with a charge controller and transfer switch built in. It has a built-in ability to be AC coupled. This engineering has an interesting implication. It can be charged by any AC power source. That includes not only the grid, but solar panels equipped with micro-inverters and even the old gas-powered generator.

Some of its design is as simple as it is impressive. The battery can reset the micro-inverter at a solar panel by a brief, very minor change in frequency. This can get the panels going if their micro-inverters have tripped in a grid failure. Conveniently, this will happen automatically.

The sonnen batteries have an impressive 10,000-cycle guarantee, which Granite State Solar has amplified with additional coverage of its own. In the end, the customer’s guarantee is extended to 12,000 cycles or twelve years. The sonnen batteries are available in a range of sizes from four kilowatt hours to sixteen. They also qualify for tax credits.

Granite State Solar’s employees have all been trained by sonnen, and they have been accredited according to the needs of their jobs. Please do not let that statement slide by without noticing an important implication: The receptionist has been trained by the battery manufacturer.

There is much more to the sonnen battery than we have room for. You can contact Granite State Solar for more. The website is www.granitestatesolar.com. ♻️



This recent sonnen battery installation in New Hampshire is an ECO-12. It provides continuous 8,000 watt output along with 12kWh of standby capacity. It can be charged by the home’s 7.8 kilowatt AC solar array, the grid, or a back-up generator. Photo courtesy of Granite State Solar.

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NASHUA SETS BOLD GOALS

Nashua's Environment and Energy Committee Promotes Bike and Solar Programs, Sets Bold Energy Goals for Buildings, Vehicles

Chris Gillespie



Nashua Mayor Jim Donchess and members of the Environment and Energy Committee join Hudson town officials and representatives from Granite State Solar and Turn Cycle Solutions in celebrating the launch of Nashua Solarize+. Photo courtesy of the Nashua Environment and Energy Committee.

Nashua, New Hampshire's Environment and Energy Committee recently presented the city's Aldermanic Planning and Economic Development Committee with a series of sustainability-focused recommendations, including goals to cut municipal greenhouse gas emissions by 25 percent by 2025 and to power municipal buildings with 100 percent clean energy sources by 2050.

Nashua's Environment and Energy Committee was formed in 2017 after Mayor Jim Donchess pledged allegiance to the Mayor National Climate Action Agenda, in which he and 273 other mayors across the country agreed to uphold the values and goals of the Paris Climate Agreement after President Trump withdrew the United States from it.

Although Nashua's Board of Aldermen is yet to officially approve the energy goals for 2025 and 2050, some of the Environment and Energy Committee's ideas have already come to fruition.

One such realized idea is Nashua Solarize+, a campaign that hopes to encourage homeowners in Nashua and the neighboring suburb Hudson to go solar and optimize the energy efficiency of their homes.

Nashua Solarize+ launched on June 1 and will run through August 31. During this time, Nashua residents who buy solar panels through Granite State Solar or weatherization services from Turn Cycle Solutions will receive a special discount. The exact amount of the Nashua Solarize+ discount will be determined by how many homeowners take advantage of the campaign—as the number of new contracts increases, so will the discount.

"We are very optimistic that a lot of people are going to sign up, so that people are going to get the greatest price," Granite State Solar's Jaimie Harris told WMUR News in regard to the campaign.

The Environment and Energy Committee has also found success in bringing easily accessible clean transportation to the Gate City. On June 3, two hundred turquoise-colored bikes were stationed around the city to kick off Nashua's four-

month pilot program with VeoRide, an adaptable, dockless bike-share system.

Using the VeoRide smartphone app, anyone in Nashua can locate, reserve, unlock and pay to rent one of the communal bikes (15 minutes of ride time only costs 50 cents).

If demand is great enough, 100 more bikes will be added to the pilot program. If the pilot program is deemed successful overall, Nashua will have the option to continue the partnership with VeoRide into the future. The pilot program, which has been described by Nashua's transportation and long-range planner Julie Chizmas as "a commuting solution as well as a recreational option," is not costing the city any money.

While the Environment and Energy Committee has already accomplished a great deal in its first year, its work is far from finished.

In addition to the aforementioned initiatives, the Environment and Energy Committee is also pushing the city to update the energy efficiency of the municipal's buildings and to adopt a standard of replacing retiring municipal fleet vehicles with vehicles that are more energy-efficient. The Committee has also suggested creating a city-wide Energy Manager position, as to better facilitate energy projects and energy tracking.

"Our goal is to really reduce our emissions and make Nashua a more enjoyable, livable and sustainable community," said Nashua Waterways Manager Madeleine Mineau, member of the Environment and Energy Committee. "We are ultimately working to save taxpayers money while benefitting the environment."

For more information on Nashua Solarize+, visit <https://nashuasolarize.com>.

Chris Gillespie is a contributing writer for *Green Energy Times*. He can be reached at chris@greenenergytimes.org. ♻️



VT SOLAR DEVELOPER HELPS NEWPORT, NH ACHIEVE NET-ZERO ENERGY STATUS

Newport voters approved by a margin of 652 to 235 a 2.2-megawatt solar energy project capable of providing the entire annual energy needs for Newport town and school facilities. The solar installation will be the largest municipal project in New Hampshire and one of the state's largest overall. Likewise, the solar arrays will make Newport the largest town in the state to net its entire municipal and school district energy demand from solar energy.

The vote on May 9th, 2018 authorized the Town and School District to enter into a 25-year power purchase agreement (PPA) with local solar developer Norwich Solar Technologies for the project.

The project will serve the school district's offices and the town's three schools, all town-owned facilities, including the public library, airport, wastewater treatment plant, as well as the police, EMS and fire departments.

Town Manager Hunter F. Reiseberg said, "Being the 'Sunshine Town' we thought that it was appropriate that the town to embrace solar power as a means of offsetting our carbon footprint and saving the taxpayers' money along the way."

In the past two years, Newport has converted all of its offices and street lighting systems to LEDs. In May 2018, the town and Norwich Solar Technologies will



begin construction of the 2.2MW solar arrays that will offset 100% of the electrical power requirements for the municipality, the school district, the library, as well as the police and fire departments. "We will, in short, be net-zero and are already seeing significant savings. It has been a home run!" said Reiseberg. Net-zero means

the total power used by the municipal and school buildings on a yearly basis is equivalent to the amount of power created by renewable sources.

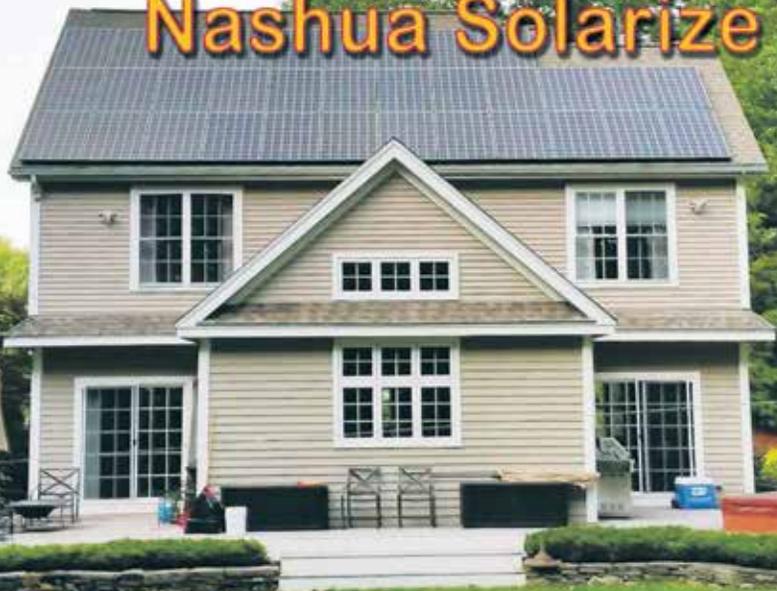
A power purchase agreement (PPA) allows the Town and schools to buy energy created by a solar photovoltaic (PV) system at a discount without having to provide any capital investment for the project. The PPA calls for the placement of solar PV arrays at the closed town landfill and on land adjacent to the wastewater treatment plant. Land selected for the solar arrays are either under-utilized or currently not developable.

Work on the project will begin immediately and, upon commissioning, the Newport will see immediate savings, with greater savings as energy prices rise over time—historically 2-3% annually. The PPA also includes a provision allowing Newport the opportunity to purchase the solar arrays at a substantial discount in the future.

In addition, "projects of *Cont'd on p.25*



Join Granite State Solar for Nashua Solarize +



Granite State Solar has been chosen by the City of Nashua as the program partner for this exciting group-buy model. Owners of homes and businesses in the communities of Nashua and Hudson are eligible for discounted solar during the Nashua Solarize + campaign. Nashua Solarize + runs through August 31, 2018.

For more information, please visit NashuaSolarize.com or GraniteStateSolar.com

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CuttyHunk Island's Microgrid

George Harvey

The Elizabeth Islands form a small chain between mainland Massachusetts and the island of Martha's Vineyard. The westernmost of these has the small community of Cuttyhunk. Because it has only fifty full-time residents, a submarine cable to supply power from the mainland is economically unworkable. The island's population swells to about three hundred during the summer including visiting boating enthusiasts who like the shelter of the island's harbor.

There is no car ferry to the island, and this helps keep Cuttyhunk quiet and clean. Its electricity, however, has always been supplied from diesel generators, a source of noise and air pollution. Depending on diesel oil also made Cuttyhunk's electric power very expensive, as the fuel had to be delivered by barge to the island. Because the price of diesel oil varies, electricity can cost as much as 75¢ per kilowatt-hour (kWh).

Last year, Solar Design Associates (SDA), of Harvard, Massachusetts, converted Cuttyhunk's electric system into a much more modern "microgrid," with most of its power coming from renewable resources backed by energy storage. An array of 1,020 photovoltaic (PV) panels supplies a maximum of just over 350 kilowatts of power. On sunny days, surplus solar power is stored in a system of lithium-ion batteries to deliver 1,000kWh



Solar array on Cuttyhunk consisting of 1,020 photovoltaic (PV) panels supplying a maximum of just over 350 kilowatts of power. Courtesy Solar Design Associates.

of energy to the island grid when solar is not available.

The Cuttyhunk microgrid retained the existing diesel generators for backup power, both for when solar is not available and battery storage is depleted and for times of especially high demand. During most of the year, the solar array will provide about 80% of the island's power, and, even in times where there are large numbers of visitors, it should provide more than half. Consumption of diesel is about 30,000 gallons less than it had been, resulting in significant savings in fuel and maintenance costs as well as reductions in pollution and noise.

Pioneering systems such as the one on Cuttyhunk provide compelling examples of how microgrids can operate in other applications. Islands dependent on diesel

fuel for power are places that can benefit immediately from solar PV systems and wind turbines, because the cost of running diesel generators is high, the reliability is relatively low, and fossil fuels have environmental issues. These are places where microgrid technology is being installed and tested, providing the experience needed to field similar systems in a growing range of applications. Solar Design Associates is currently designing another solar-plus-storage microgrid to power an island off the coast of Maine.

Apart from addressing cost and pollution problems, microgrids based on renewable energy and battery storage technologies provide increased energy security. On Cuttyhunk, this is significant because the solar system's power supply is no longer entirely dependent on oil, which is subject to price and availability fluctuations, and because the diesel system needs regular maintenance by technicians from the mainland. Interruptions in service can also be lengthy, so many such locations rely on multiple generators to keep the lights on.

Even on the grid-tied mainland, production and

transmission issues can lead to lengthy power failures. One way to address these problems is to develop renewably-powered microgrids. The sunlight is delivered free, and these systems require very little attention.

The cost of solar electricity has declined to the point where it is competitive with wind power to produce the lowest cost electricity in large parts of the country. Both solar PVs and wind power have reached a point where, coupled with storage, they now are competing with natural gas to become the least expensive source of electricity.

Seven Strong, founder and President of SDA, explained, "While solar plus storage is an especially compelling approach for island communities dependent on high-cost diesel generators or costly-to-maintain cables, we've developed solar plus storage solutions for commercial, industrial, educational and utility customers as well. We see enormous potential around the world for this transformational energy technology. Storage is truly the next frontier."

The website of Solar Design Associates is <http://solar design.com/>. ♻️



The Market at Cuttyhunk, Massachusetts. Photo: John Phelan, Wikimedia Commons

Offshore Wind Power Is Coming to the Northeast



Block Island Wind Farm. Photo: Ionna22, Wikimedia Commons.

On May 23, announcements relating to offshore wind power came from three different states in the Northeast. Currently, the United States has a total of 30 megawatts (MW) of offshore wind power capacity at one site, the Block Island Wind Farm. Each of the three announcements related to large multiples of that amount.

Massachusetts Governor Charlie Baker's administration signed with Vineyard Wind to purchase 800 MW of power. Now that the wind farm has a customer, it can get financing for construction. The wind farm was one of three competing to supply electricity from the waters off Martha's Vineyard.

On the same day, Rhode Island Gover-

nor, Gina Raimondo, announced that her state had chosen Deepwater Wind to develop a 400 MW wind farm in federal waters off her state. Deepwater Wind is the company that developed the Block Island Wind Farm.

Both Rhode Island and Massachusetts plan to see other wind farms develop in their waters. Their coal-burning and nuclear plants are closing and developing power plants that burn natural gas seems increasingly unlikely.

The news from New Jersey is that Governor Phil Murray signed a number of pieces of legislation relating to energy. One of them commits the state to developing 3,500 MW of offshore wind power. According to the American Wind Energy Association, this is the greatest commitment to offshore wind power by any state.

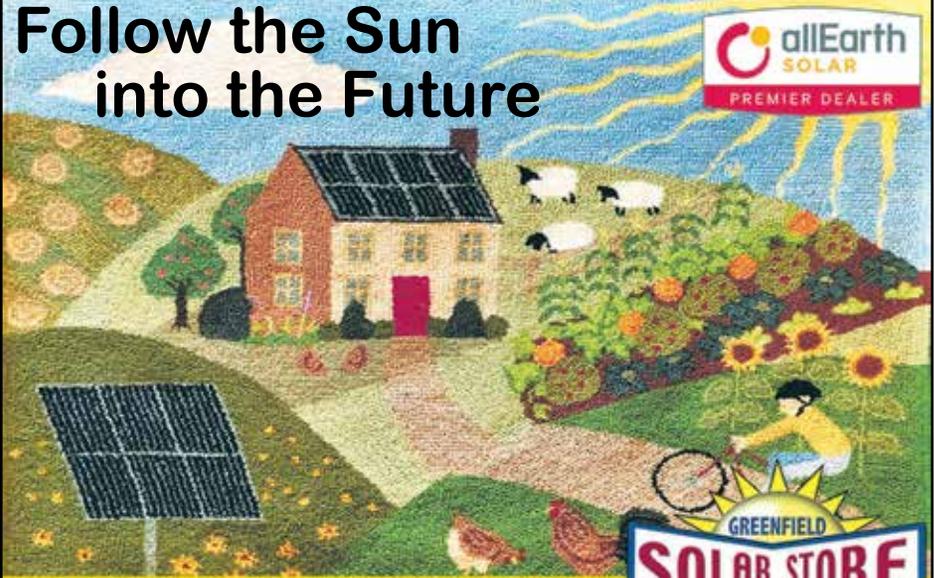
The same law that commits New Jersey to 3,500 MW of offshore wind power provides for its first commitment to energy storage. With enactment of the new law, the state is on a course to have 2,000 MW

of battery storage installed by 2030.

Another bill Governor Murray signed is noteworthy. It provides a \$300 million per year in support of the Hope Creek and Sa-

lem nuclear power plants. They are unable to compete with newer, more competitive energy sources, but they supply 36% of New Jersey's electricity. ♻️

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Artist: Christine Pellerin

**2 Fiske Avenue
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solarstoreofgreenfield.com**

FEDERAL

FEDERAL INVESTMENT TAX CREDIT

The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 30% of expenditures. 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>
- 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 the energy independence of the United States
- Promote resource conservation, public health, and the environment
- Diversify markets for agricultural and 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. For more information: www.RERC-vt.org or call (877)888-7372.

Advanced Wood Heating

- Advanced wood pellet heating systems -- \$3000 per boiler/furnace
- Custom Rebate \$1.25/ft2 of heated space, \$25,000 max (\$20,000 max for heating system and \$5,000 additional incentive if system includes thermal storage, \$10/kBtu thermal capacity).
- **Details at www.RERC-vt.org or call (877)888-7372**

Windham County

- For residential low- and moderate-income residents there is a pellet stove program. Contact the Windham and Windsor Housing Trust for more information: Tara Brown at 802-246-2119
- For wood heating (pellet or chip boilers/furnaces) in municipal buildings, schools, and non-profits contact the Windham Regional Commission: Marion Major at 802-257-4547 ext. 109 or windhamregional.org/energy/www

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

VT TAX CREDITS

- Vermont offers an investment tax credit for installations of renewable energy equipment on business properties. The credit is equal to 24% of the "Vermont property portion" of the federal business energy tax credit from 2011 to 2016. For solar, small wind, and fuel cells this constitutes a 7.2% state-level credit for systems and for geothermal electric, microturbines, and combined heat and power systems, this constitutes a 2.4% state-level tax credit.

Tier III programs

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

EFFICIENCY VERMONT

Lighting (must be ENERGY STAR®)

- Special pricing on LEDs at Vermont retailers for as low as \$.95.

Home Efficiency Improvements

- Improvements: air sealing, insulation and heating system upgrades - up to \$2,500 in incentives by using a participating* contractor

Appliances (must be ENERGY STAR)

- Dehumidifiers \$25 - \$40 mail-in rebate
- Clothes Washers - \$40 - \$75 rebate
- Refrigerators - \$40 - \$75 rebate
- Clothes Dryers - \$50 to \$400 rebate

Heating/Cooling

- LP/Oil boilers & furnaces - \$250 rebate*

- Select smart thermostats - up to \$100 rebate
- Solar water heaters - \$950 rebate post installation
- Heat pump water heaters - \$300-\$500 rebate or point of purchase discount
- Central wood pellet boilers (excluding outside wood systems) - \$3,000 rebate
- Circulator pumps - \$15-\$50 point of purchase discount
- Cold climate heat pumps \$600-\$800 point of purchase discount

Residential New Construction

- Enroll to receive a home energy rating, expert technical assistance, and incentives - Efficiency Vermont Certified™ projects receive up to \$3,000 cash back

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

Other Opportunities To Save

- Advanced Power Strips - special pricing starting at \$6.95*
 - Pool Pumps - up to \$600 rebate on select ENERGY STAR models
 - Commercial Refrigeration Evaporator Fan Motors - \$60-\$100 each w/ point of purchase discount
 - Heat Saver Loan - low-interest loans of up to \$35,000 for home weatherization and heating improvements
 - For commercial refrigeration, lighting, or HVAC rebates, apply online for a 20% bonus at rebates.encyvermont.com
- 1. *all rebates/incentives subject to availability, limits and may change - for complete incentives and requirements, and for participating retailers/contractors, visit encyvermont.com or call 888-921-5990*

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

NH PUC: Get up-to-date information at <http://bit.ly/puc-nh-RE-rebates>

Commercial Solar Rebate Program

- waitlist; closed to new applicants

Category 1:

≤100 kW AC incentive levels for PV systems:

- \$0.70/watt (lower of AC and DC) for new solar electric facilities
- 0.65/watt (lower of AC and DC) for new solar electric facilities
- Expansions to existing solar systems are not eligible.

≤100 kW AC equivalent incentive levels for solar thermal systems:

- \$0.12/rated or modeled kBtu/year for new solar thermal facilities fifteen collectors in size or fewer;
- \$0.07/rated or modeled kBtu/year for new solar thermal facilities greater than fifteen collectors in size; and
- Expansions to existing solar systems are not eligible.

Category 2:

> 100 kW AC and ≤500 kW AC incentive level for PV systems

- \$0.55/Watt AC for new electric facilities.
- Expansions to existing solar systems are not eligible.

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

Note: Category 2 may have a waitlist.

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

PACE

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. Visit <http://cpace-nh.com/index.html> for more information.

Residential Solar and Wind Rebate Program

- Waitlist only until funding available; no new applications being added to waitlist. Check for updates at <http://bit.ly/NHResidentialRebate>

Contact karen.cramton@puc.nh.gov

Residential Solar Water Heating Rebate Program

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

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

- waitlist and closed to new applicants.

- 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

- waitlist and closed to new applicants.

40% of installed system up to \$10k

- Must meet thermal efficiency and particulate emissions standards

Contact barbara.bernstein@puc.nh.gov

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

LOCAL INCENTIVES

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

- These are offered on a town-by-town basis.
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes
- Visit <http://www.nh.gov/oep/programs/energy/pace/index.htm> for more information.

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

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

NHEC offers incentives for Level 2 Electric Vehicle Charging Stations.

- For Commercial and Municipal Members up to \$2,500
- For Residential Members up to \$300 using Time-of-Use (Off Peak) rates
- Pre-approval is required.
- Visit: <https://www.nhec.com/>

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 50% instant rebate for eligible weatherization improvements up to a \$4,000.

- 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/appliances.
- 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 certain ENERGY STAR® certified LED light bulbs purchased through participating NH retailers, and instant or mail-in rebates available on ENERGY STAR® certified light fixtures (varies by retailer, see store associate or rebate form for details). For more information please visit www.NHSaves.com/lighting.
- Rebates are available only to residential electric customers of the four NHSaves utilities.

NHSAVES Online Store

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

PAREI

- To explore the possibility of a solar installation. Plymouth Area Renewable Energy Initiative. www.plymouthenergy.org
- www.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 - \$600 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.nh.gov/oep/programs-weatherization/index.htm for application criteria, FAQs and local program contacts

MASSACHUSETTS

Commonwealth Solar Hot Water (SHW) Programs

- Applicants must be served by National Grid, Unitil (Fitchburg Gas and Electric), Eversource or a participating Municipal Light Plant community
- Homeowners are eligible for a base rebate amount of the lesser of \$4,500 or 40% of the installed cost. The system may also be eligible to receive additional funding (“adders”) which increase the amount of the rebate. Adders are detailed in the program manual at http://files.masscec.com/get-clean-energy/residential/commonwealth-solar-hot-water/SHW_Program_Manual_Small_Scale.pdf
- Visit <http://www.masscec.com/programs/commonwealth-solar-hot-water>

MassSave Heat Loan SHW

- Through this loan program, customers may borrow at 0% interest the costs of a Solar Domestic Hot Water and/or Thermal Heating system. Apply through receiving the MassSave Energy Audit. You can borrow up to \$25,000 at 0% interest for a 7-yr term.

Energy Efficiency

- After conducting a free residential Energy Audit, residential customers are eligible for up to \$25,000, commercial loan up to \$100k at 0% interest heat loan with terms up to 7 years to cover the following energy efficiency improvements: attic/wall-base-ment insulation, high efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows
- Available only to utility customers of W. Mass Electric, National Grid, Berkshire Gas, Nstar, Unitil and Cape Light Compact
- Visit www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program Please call 866-527-7283 to schedule a free home energy assessment.

Mass. Solar Loan Program

Mass Solar Loan focuses on connecting homeowners who install solar PV systems with low-interest loans to help finance the projects.

- The \$30 million program, a partnership between the Massachusetts Department of Energy Resources (DOER) and MassCEC, will work with local banks and credit unions to provide financing to homeowners interested in solar electricity. DOER's program works with banks and credit unions to expand borrowing options through lower interest rate loans and encourage loans for homeowners with lower income or lower credit scores.
- Since 2008, the solar electric industry in Massachusetts has grown into a robust economic sector with over 1,400 businesses and 12,000 workers, with enough solar electricity installed in the Commonwealth to power more than 100,000 homes.
- Mass Solar Loan will continue to grow

this sector, while allowing more homeowners the ability to achieve the cost savings and environmental benefits of this clean, renewable energy source. www.masssolarloan.com. The most updated loan principal buy down rate based on household income can be found at <http://www.masssolarloan.com/>.

DEPT OF ENERGY RESOURCES

- The Massachusetts DOER is in the process of designing a new solar incentive program. The latest information can be found at <http://bit.ly/SMART-Solar-Incentives-Program>.
- Solar renewable-energy credits (SRECs) associated with system generation belong to the system owner and may be sold via the Department of Energy Resources (DOER) SREC 2 program. Systems sized under 10kW single phase or 25kW three phase have an extension until the new incentive program starts in 2017. Note: appropriate, approved Data Acquisition System monitoring must be utilized for PV systems >10kW in order to qualify to sell SRECs.
- Next solar incentive information can be found at <http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/development-of-the-next-solar-incentive.html>
- MA State Income tax credit for residential solar hot water or PV systems are eligible for a one-time 15% off system cost, capped at \$1000 max tax credit.
- No sales tax on residential solar hot water or PV system.
- There is no increase in property tax assessment for residential solar hot water or PV systems for 20 yrs.

MA SREC II Policy

Massachusetts' Solar Renewable Energy Credits Program, SREC II prioritizes sites, by using an SREC factor based on the type of installation.

- The credits provided for energy produced by a system are calculated by multiplying the factor times a full credit value.
- Full credit is given for residential, parking canopy, emergency power, or community-based systems, or any other system of less than 25 kW.
- Larger systems get a factor of 0.9, if they are building-mounted or at least 67% of the power produced is used at the site. If a larger system meets neither of these criteria, but is built on a landfill or brown-field site, or if it is less than 650 kW, then it gets a factor of 0.8. Systems that qualify for none of the foregoing get a factor of 0.7.
- Expect changes in spring 2018.
- http://bit.ly/Mass_SREC_II.
- MA State Incentives can be found at: www.masscec.com/get-clean-energy

Heating Programs

- The Commonwealth Woodstove Change-Out program, a partnership between MassCEC, the Massachusetts Department of Environmental Protection and the Department of Energy Resources, offers rebates to assist Massachusetts residents in replacing non-EPA-certified wood stoves with cleaner, more efficient EPA-certified wood or pellet stoves.
- Woodstove Program Info: <http://bit.ly/mass-cec-woodstoves>
- Heat Loan info: <http://bit.ly/mass-save-heat-loan>
- Insulation Incentives: <http://bit.ly/mass-saves-home-insulation>

Electric Vehicles

- MOR-EV provides rebates of up to \$2,500 for the purchase or lease of zero-emission and plug-in hybrid light-duty vehicles. Visit: <https://mor-ev.org/>

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NYSEDA

Welcome to the 2017 New York solar incentive and rebate information: 169 programs and incentives at: <http://dsireusa.org> (enter your zipcode) Programs and Services from NYSEDA:

- <https://www.nyserda.ny.gov/All-Programs>

EV Incentive from National Grid

National Grid, in partnership with BMW, is bringing eligible customers a \$10,000 purchase incentive on a new BMW i3 or BMW i3s electric vehicle. Valid through July 31, 2018.

- Form is at <http://bit.ly/NG-BMWi3>.

Home Energy Waste

Getting a home energy assessment can help you take control of your energy costs. It can identify where your house is using the most energy and which improvements would have the biggest impact on your bottom line. Heating and cooling costs frequently account for 50% of residential energy bills. Identifying your energy waste can lead to big savings.

Visit: <http://bit.ly/ny-nrg-waste>.

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NY-SUN

<http://ny-sun.ny.gov/>

NY-Sun is structured around customized Megawatt (MW) Blocks targeted to specific regions of the state. To learn more, see the Megawatt Block Incentive Structure.

The Megawatt (MW) Block Dashboard provides real time information on the status of block and current incentive levels by sector and region. Block status is updated as applications are submitted, so click the refresh button to see the current status.

- <https://www.powerclerk.com/nysuninitiative/dashboard.aspx>

Residential and Small Business

<http://ny-sun.ny.gov/Get-Solar/Residents-And-Small-Business>

Commercial and Industrial

- <http://ny-sun.ny.gov/Get-Solar/Commercial-and-Industrial>

Community Solar

- <http://ny-sun.ny.gov/Get-Solar/Community-Solar>

Commercial/Industrial PV Installer

- <http://ny-sun.ny.gov/For-Local-Government/Local-Government>

Residential/Small Commercial Solar PV Installer

- <http://ny-sun.ny.gov/Get-Solar/Find-A-Solar-Electric-Installer>

Financing Options

- <http://ny-sun.ny.gov/Get-Solar/NY-Sun-Financing>

Clean Power Estimator

- <http://ny-sun.ny.gov/Get-Solar/Clean-Power-Estimator>

Geothermal

- rebate of \$1500 per ton of installed capacity for residential/small-scale systems, \$1,200 per ton for commercial/large-scale systems up to \$5000

Electric car

- buyers in New York State can now get a rebate of up to \$2,000 on qualifying EV models from participating dealers. See <https://www.nyserda.ny.gov/All-Programs/Programs/Drive-Clean-Rebate/How-it-Works>.

Utility sponsored incentives & tips:

http://bit.ly/utility_sponsored_incentives

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

CAPTURING CARBON AND DOLLARS: MECHANICAL AND BIOLOGICAL PATHS

Roy Morrison

Our recent business-friendly Trump tax cut extravaganza now makes capturing carbon emissions from fossil fuels probably economical by paying \$30 dollars a ton for carbon capture and storage. Compared to pollution and ecocide-as-usual this may be a good idea, as suggested by MIT Technology Review on April 25th.

Financial engineering has finally opened the door for carbon capture and storage. Tax subsidies for carbon capture are now part of our latest corporate-friendly tax overhaul. The credit under U.S. Code 45Q Credit for Carbon Sequestration would provide \$30 a ton benefit for the first 75 million metric tons of sequestered carbon or \$2.25 billion. This could be the start of something big. A \$30 dollar a ton tax credit subsidy for carbon dioxide capture and storage (CSS) means the cash registers are ringing. Wall Street is mobilized.

Fossil fuel plants generate huge amounts of carbon dioxide by weight, because one atom of carbon combines with two atoms of oxygen. This means an average of 1.2 pounds of carbon dioxide per kilowatt hour of fossil fuel electricity. A thousand megawatt fossil fuel plant at 70% capacity factor would produce 3.7 million tons of carbon dioxide a year.

At \$30 a ton, this means \$111 million dollars in tax equity a year. Every year. Not a onetime thing like the solar investment tax credit (ITC). For solar, tax equity investors who take advantage of the 30% solar energy ITC are typically cash-rich insurance companies or family offices, the quaint term for the administrators of the wealth of the very rich, who want to avoid taxes and make even more money without lifting a finger. Power plant owners may have requisite tax appetite to take advantage of carbon capture tax credits themselves, so the tax credit is a direct benefit to these companies and their stockholders.

Allegedly, this tax subsidy will lead to decreasing costs and will phase out. Allegedly. But history suggests otherwise in particular in regard to fossil fuel subsidies and with this one supported by coal miners and environmentalists alike. And both Wall Street and Technology Review believe that scouring carbon from the air is inevitably to follow if we are to save ourselves.

It is certainly better paying polluters not to poison as much to avoid ecological catastrophe, mass extinction and an end to what we call advanced "civilization".

Dodging the Threat of Stranded Assets by Fighting Climate Change

Globally, coal plants are being shut down because they are simply not competitive with renewables and natural gas. The greatest threat to the fossil fuel imperium is the increasing inability to compete with zero fuel cost renewables combined with limitations on unabated carbon dioxide pollution to save us from



ecological catastrophe.

We should understand that by adding carbon-capture subsidies to keep fossil fuels economic and ecologically tolerable is also very much about preserving the trillions of dollars in anticipated value of coal and oil in the ground by subsidizing zero or low enough emitting fossil fuel combustion. This is guaranteed to warm the hearts of the Koch Brothers, Exxon Mobil, Vladimir Putin, Donald Trump, and OPEC. It also preserves the value of millions of dollars of fossil fuel generation and heating plants that are becoming stranded assets in face of renewable competition.

Utility plant is still the largest global agglomeration of machine capital all of which is likely to be abandoned in the face of increasingly cheap wind, solar and storage batteries. Hawaii, for example, committed to 100% renewable power, has just passed a law mandating a completely new utility rate structure based not on power sales and plant investment, but on efficiency and making the system favorable for renewable development. Hawaii electric is getting out of the fossil fuel business and will make money as coordinator and facilitator of the renewable energy grid. Efficiency and distributed renewables are no longer threats to the utility bottom line, but the basis of profit. This is a crucial transformation that must be followed nationally and globally for real market incentives for a renewable energy future.

Right now the U.S. Department of Energy is attempting to provide subsidies without pollution mitigation in the name of "grid reliability" and "grid security" and subsidize coal and nuclear plants that cannot compete with renewables and with natural gas. That is the old time religion and has less than overwhelming support, since it benefits only a very few at the expense financially and ecologically of the many, and at the same time, severely damages existing competitive electricity markets in an exercise of lemon socialism. Ratepayers are supposed to pay more and be rewarded with nothing. These plants if non-economic are certainly for sale. To keep them open (which I oppose completely) they should be sold for pennies on the dollar to a willing buyer or shut down. Not one quarter more of fossil fuel subsidies.

Fossil fuels will not be able to compete with zero fuel cost renewables absent ever rising subsidies such as paying companies with tax credits or other emoluments for not polluting. This is all about maintaining the value of oil and coal assets in the ground by subsidy forever.

The essential market problem is driven

by the nature of renewables and ecologically unsustainability of fossil fuels.

Sun, wind, water fuel cost is zero. And renewable capital cost continues to drop and efficacy continues to increase. This creates a problem in that to afford the costs of the fossil fuel chain and remain competitive, fossil fuel burners must receive an ever increasing amount of subsidy.

The notion advanced in Technology Review that an alleged incapacity of renewables in northern climates ("wind too strong", "not enough sun") is a fanciful, not data driven assertion. And one that's used to justify an endless subsidy regime for fossil fuels.

Industrial Nostalgia

A coal museum now has solar panels. This is where the storied history of fossil fuels belongs, in a solar powered museum of the history of fossil fuel powered industrialism. The story of coal miners, of wildcatter, and roughnecks on oil rigs, of the Big Allis turbine on the Hudson (for Allis-Chalmers) powering N.Y. City. It's "16 tons what do you get, another day older and deeper in debt."

I once passed a course and became a certified steam boiler operator to improve my skills as institutional energy auditor. At the time, I was fascinated by the big machines with their maze of water tubes and explosion doors on the top to release pressure in case something went wrong. We burned sludgy, number 6 bunker oil plant that needed to be heated in order to be pumped into the combustion nozzles at the University of New Hampshire boiler plant.

Now the jobs are being created in the hundreds of thousands by solar and wind. The roughnecks can work on building and maintaining wind farms from prairie to the deep ocean. Every large wind farm is supported by a machine shop.

Scrubbing Carbon Dioxide from Atmosphere

MIT jumps from the glories of subsidizing carbon capture to suggest that mechanically removing carbon from the atmosphere will be almost certain to be needed next step. This is a motor head solution as opposed to using carbon sequestration from land and ocean biomass and soil. To choose the path to follow to reduce atmospheric carbon, to remove gigatons of carbon dioxide from the atmosphere, we should turn first to the power inherent in the biosphere to restore a favorable ecological balance.

It's important to understand the Eocene Thermal Maximum (ETM) period of 55 million years ago. Driven by carbon dioxide and methane from volcanism, global temperatures soared on an ice free planet. The ETM extreme temperatures and carbon dioxide led eventually, in the open Arctic Ocean, to enormous plant blooms in the ocean that feasted on gigatons of CO₂ on an overheated planet and helped establish the current carbon balance and de-acidify the oceans.

The deliberate growth and cultivation of sea plants such as kelp and duckweed and micro-algae forests is a key pathway to sequestered the gigatons of carbon to help reverse climate change and clash ocean acidity before it is too late. Huge and rapidly growing biomass can provide not just carbon sequestration, but food and energy through bio-methane poten-

tially sufficient to replace all fossil fuels.

A chemical engineering study by Antoine de Ramon N'Yeurta et al., "Negative Carbon via Ocean Afforestation," estimated that ocean plants can solve our global climate, energy, and food problems. Micro-algae forest covering 9% of ocean could produce enough bio-methane to replace all fossil fuels while removing 53 gigatons per year of carbon from the atmosphere and restoring preindustrial levels of carbon. The enormous growth of ocean biomass would also increase sustainable fish production sufficient to provide 440 pounds of protein per year for 10 billion people. There are related and enormously promising proposals for fast growing ocean plants like kelp and duckweed.

This would be an enormous undertaking, but it is driven by the use of the natural processes of plants in the ocean feeding on carbon dioxide and using photosynthesis to create enormous amount of biomass. It should be a matter of immediate attention before we decide the only choice is building millions of machines to attempt to scrub carbon dioxide from the atmosphere. Let nature do it instead. The biosphere is a co-evolutionary system designed to restore a sustainable balance in the interest of life. Human choices to choose to employ the power of ocean biomass as opposed to legions of machines is another manifestation of sustainability.

The co-evolutionary forces of sustainability, the ecosphere responding to all influences in a fashion that reshapes the planet to support life in all its diversity will likely, as it has in the past, enable survival after the mass extinction of the Anthropocene. But it's preferable for us acting quickly enough to avoid mass extinction.

Yes, we need a plan, in my view, eight four-year plans from 2018 to 2050 to get to a global carbon dioxide equivalent emissions of 21 gigatons per year (three tons of carbon per person per year (or less) as global standard for each us everywhere) combined with aggressive steps for carbon sequestration on land and sea in multi-gigatons per year level. Agriculture, forestry, aquaculture should be paid for carbon removal instead of subsidizing continued use of fossil fuels. At the very least, natural sequestration of carbon should be paid similar amounts as mechanical carbon capture.

Better to pay the devil some now and save ourselves from ecological catastrophe. The economics of renewables will provide clear global answers for climate change soon enough.

Roy Morrison's latest book is *Sustainability Sutra*. He works on solar farms and dual-cropping for farmers to produce both food and renewable energy, www.dual-cropping.com.



Why Real Estate and Insurance Lobbies Will Influence Climate Policy

Kenan Sahin

When the real estate and insurance industries more aggressively translate the risk of weather/climate volatility to each person's pocketbook, the hue and cry will be huge.



Flooding during hurricane Harvey. Image: nbcnews.com.

Climate change is often seen as synonymous with global warming, a misperception deriving from the historical mislabeling of the phenomenon.

Certainly, "warming" is part of it, but the real danger is the increasing variations or the greater-than-normal fluctuations in all aspects of climate: temperature; humidity; winds; rain; snow; hurricanes; seasons; etc.

It is like noting stock price averages but ignoring volatility, or measuring average blood sugar levels but ignoring wild fluctuations.

Often, the big risk is the volatility.

Why don't scientists aggressively emphasize this? Science is a cautious practice where data must pass a high level of scrutiny. Powerful vested interests have turned against scientists and politicized climate change, making the scientists even more timid.

Who can extricate the climate debate from the clutches of dogmatism and par-

titanship? The answer is those who would be adversely affected by climate "volatility" and whose political strength can outweigh the forces that have fostered the climate change denialism: real estate and insurance.

Weather volatility (short term) and climate volatility (long term) are intensifying. Above-ground structures, key components of real estate, will be affected in dramatic ways over and beyond what already has happened, hence the prediction that real estate and insurance aggressively will lobby for policies to rein in weather-climate volatility.

THE STAKES ARE HUGE

Existing structures were built using engineering safety standards based on extreme loads seen in the past centuries. When once-in-1,000-year floods, hurricanes or heat waves become more frequent, historic safety margins easily

will be exceeded. The debate should shift focus on weather-climate volatility rather than warming. Nature's "margin calls" can be ruinous.

Insured values of properties in 100 eastern coastal counties are reported to be \$10 trillion. New York and Florida account for \$3 trillion each. Insured and uninsured values of all structures across the United States potentially exposed to weather and climate "violence" easily will reach well over \$100 trillion. And infrastruc-

ture such as bridges, roads, dams, utility poles and power stations that makes real estate usable also runs into the trillions.

Even an additional half-percentage point of annual risk could cause damages of half a trillion dollars or more. Hurricane Harvey caused \$160 billion in damage to Texas. Combined with other volatility damages the same year, the total could well have been \$200 billion plus. So, predicting \$500 billion plus annually in years to come would not be far off.

All of this potential damage is not lost on the real estate and insurance industries. Their journals are full of warning articles preparing them to descend on policymakers.

And when that happens, the debate rapidly could shift from the current blame game of who causes greenhouse gas emissions to what can be done. In the case of epidemics or earthquakes, we do not debate if people cause them. Instead,

we take extensive measures to mitigate their harmful effects. The same rationality should, and very likely will, apply to the climate debate where trillions are at risk.

This risk touches everybody, including each and every politician, as we are all direct or indirect real estate owners and pay insurance premiums. When the real estate and insurance industries more aggressively translate the risk of weather/climate volatility to each person's pocketbook, the hue and cry will be huge. We are at the threshold of that collective cry.

On the policy front, a low hanging fruit is electric vehicles (EVs). Twenty five percent of fossil fuels are used in vehicles. Carbon dioxide emissions from transportation exceed that from power generation. If vehicles were electrified on a mass scale, utility companies could shift vehicles to clean energy from wind, solar or even nuclear.

By 2035, about 150 million vehicles will be made globally with more than 75 million EVs, primarily outside the United States — a \$2 trillion industry emerging mostly to the benefit of China and others. Promoting EVs would help the U.S.

economy and reduce greenhouse gas emissions on a massive scale. It is a double win that the real estate lobbies might and should demand aggressively.

Decades back, scholars equipped equity markets with volatility metrics such as alpha, beta and standard deviation, which led to more rational investing.

It behooves the climate scientists to formulate good measures of weather/climate volatility so that the real estate and insurance industries, and the public, can more effectively and persuasively confront the politicians and resistant citizens and precipitate effective policies.

Kenan Sahin is the Founder and President of CAMX Power. Learn more about Mr. Sahin at <https://www.greenbiz.com/users/kenan-sahin>.

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The End of Fossil Fuels is In Sight

George Harvey

On May 23, the price of General Electric (GE) stock fell steeply. This happened because GE announced that its power division is not making money. The power division makes steam and gas turbines for fossil fuel and nuclear plants, but it does not make wind turbines. The wind division at GE is making money, but not enough to make up for the power division's slow sales.

Other makers of steam and gas turbine are also slogging along in an increasingly tough market. Siemens is not optimistic. Mitsubishi really spelled things out clearly, saying that it expects the steam and gas turbines market to "run dry" by 2020.

We must consider that projections from the United States Department of Energy (DOE) would make things seem rosy for the natural gas industry. The DOE says natural gas is expected to have more capacity installed than all renewable energy technologies combined in 2018, the first time that has happened since 2013. But we have to remember that the natural gas plants



Fracking in Pennsylvania. Photo: Ruhrfish, GFDL, CC-BY-CC.

coming online were ordered quite some time ago, when gas prices were especially low. It takes years to find sites, get permits, arrange for financing, and build the plants. The plants may all go to completion, even if their owners do not see a lot of chance to make money with them, because otherwise they would certainly be big money losers.

We should all have seen this coming. While some gas advocates and even gas investors refused to look at the clear evidence, there were other, less optimistic numbers being posted by the DOE's Energy

Information Administration. Production of electricity by gas-burning plants in the U.S. in 2017 was down over 8.5% from 2016, despite additions of new capacity. More capacity generating less power means that the economics of natural gas plants in the U.S. worsened quite a lot during that period.

We also have news that speaks to how electric utilities feel about the future. On May 23, just as GE shareholders were selling off holdings because the gas turbines were not selling, two major utilities, with a total of 5.5 million customers, made relevant

announcements. Vistra Energy Corporation and Dominion Energy Inc. both announced that they would not build any more combined cycle natural gas power plants. When these two utilities need more capacity, they will add solar farms because of their economic advantages over gas. They had decided to do this despite the fact that the federal government has put tariffs on solar panels.

At the same time all this news appeared (along with announcements on offshore

wind power from three states, see "Offshore Wind Power Coming to the Northeast," on page 15), we got a projection on the future of solar power from GTM Research, which specializes in market research for companies and technologies relating to green energy. GTM Research's projections have costs for solar panels falling to 24¢/watt by 2022. It said it expects the cost of fixed-tilt utility-scale systems to fall to 70¢/watt in the same time. And according to the company, this means the cost of electricity from utility-scale solar systems could fall to 1.5¢/kWh or lower.

Meanwhile, battery backup power has become so cost-effective that it can take up the electricity supplied to the spot market by fossil fuels. (Please see the article "The Disruption Has Begun," on page 1, for a discussion of this.)

Wärtsilä is a Finnish company that makes some of the biggest combustion engines on earth. In April, at a Bloomberg New Energy Finance summit in New York, the president of energy solutions at Wärtsilä, wondered aloud about the future of natural gas generation. His suggestion was that anyone who built a new combined-cycle natural gas plant might be, to use his term, "crazy."

Clearly, we would agree. The future looks bleak for natural gas, which only recently vanquished coal. ♻️

CLIMATE TRUTH: A PLAN FOR SUSTAINABILITY

By Roy Morrison

There is a practical path for tackling climate change, for organizing from your house to your neighborhood, city, state and beyond. It's clear. It's simple. It's three tons of carbon dioxide emissions per person per year as a goal and a measure for global sustainability.



Metric Ton Depiction: Flickr, animation by A-Production

Three tons is the basis for personal and collective action and planning on all levels. It is, and must become, the acceptable local and global standard first measuring where we are, sustainable or endangered, and as a guide to reaching sustainability.

Three tons per person per year of carbon dioxide emissions is a simple number. In the global aggregate, 21 gigatons of carbon dioxide emissions a year, more or less, is the sustainable global limit for natural cycles to keep atmospheric carbon dioxide levels level. A gigaton is a billion tons. This means that 21 gigatons is about three metric tons per person per year, or 6,612 pounds per year for each of us. Three tons per person per year of carbon dioxide from primary energy consumption equal to 70 gigajoules or 19,443 kilowatt hours a year was set as a sustainable global target for all by the U.N. in 2011. Remember that three tons per person per year number. That's the target we need to keep in mind if we are to stop and then reverse the steady march toward climate catastrophe.

Three tons by itself is not enough given the carbon dioxide we've already added to the atmosphere and are continuing to do so. Three tons, or even less, as planetary target must be combined with global cooling also aggressively remove carbon from the atmosphere and sequester in soil or biomass or otherwise remove and store it.

Yes, this is a global problem. But, from the other end of the telescope, climate change is the collective consequence of what all 7.6 billion of us do. Our opportunity and responsibility is to act from where we are, to take part in what must become a global movement from the bottom up for global ecological and social change.

Current total global carbon emissions were 34 gigatons in 2017, an average of 5.5 tons carbon per person per year. This means collectively a 13-gigaton of carbon dioxide yearly excess. This is reflected in the relentless increase in atmospheric carbon measured by the Mauna Loa laboratory in Hawaii, now above 400 parts per million and rising from the pre-industrial level of below 300 parts per million.

Globally, at first glance, what's the big deal? We just have to cut carbon emissions by a little more than half. Unfortunately, it's not that simple. Some of the 7.6 billion, mostly poor people in poor nations are already way below three tons. The more "advanced" the economy, the greater the carbon pollution. The rich, not the poor, are the global carbon hogs and are respon-

sible for the lion's share of historic and current pollution.

In Mali, the average emissions for 18 million people was only one-tenth of a ton of carbon dioxide per person in 2014 according to the World Bank, or 1.8 million tons total of carbon dioxide. In the United States, for 300 million of us, it's an average of 16.5 tons per person per year or 4.95 billion tons of carbon dioxide per year. That's 2,750 times greater than Mali. If we all lived like Americans, as many aspire to, global emissions would be 125 gigatons a year or about six times greater than sustainable levels. But we have only one Earth, not six.

There is another choice. We can make and implement plans for a three tons of carbon per person future starting where we live. Right here. Right now.

Three tons per person per year of carbon dioxide equivalent is the basis for global convergence on sustainable conduct, for a global technological and social revolution based on making economic growth mean ecological improvement and for the pursuit of social and ecological justice and an end to poverty. Carbon dioxide equivalent includes the climate change effects of the emissions of other greenhouse gases like methane. Three tons per person emissions per year when combined with removing carbon dioxide from the atmosphere through soil building and biomass on land and sea will stop and reverse climate change.

Unfortunately, today almost none of us have any idea what our actual share of the problem is, nor do we understand what a sustainable level of emissions is. We don't know the facts about the concrete goal we really need to be working toward and fighting for and how to measure our progress. Instead, we get lost in ever-shifting and incomprehensible blather about how much warming is deemed acceptable. The acceptable number continuing to rise (in order to keep business – and pollution – as usual churning) as the "acceptable" target increases from 1.5 degrees centigrade to two, to three, to four, to five degrees centigrade. Business and pollution as usual offer half-measures and promises action just in time, if we are lucky, before the planet warms sufficiently to cause massive crop failure as industrial civilization collapses amidst flood, drought, famine, war, mass migration of the desperate, and epidemics. All fall down.

There is another choice. We can make and implement plans for a three tons of carbon per person future starting where we live. Right here. Right now.

The global pursuit of three tons of carbon must be a reflection not of economic

contraction and global depression, but of economic growth resulting in ecological improvement. This is global economic growth rooted in the community ownership of the new global efficient renewable energy system and ecological production systems. It is a plan for community empowerment and for asset building and a global sharing of resources as investment to help empower the global poor to build the sustainable energy and productive infrastructure. Unless this transformation, this 3 ton mantra for salvation, is global and shared, we cannot succeed to save ourselves in a world half sustainable and half mega-polluting.

A 100% renewable energy transition globally by 2050 is both technological possible and will reduce the average cost of energy by 30% from current fossil fuel and nuclear power prices, according to a comprehensive 2017 study of the European Energy Watch Group led by physicist and German PV pioneer Hans-Josef Fell and performed by Berlin's Lappeenranta University of Technology. The study employed hourly simulation data for modeling 145 global regions using a mixture of renewables, primarily PV and wind and energy storage. Carbon dioxide emissions are radically reduced by 2030 and largely disappear by 2050 from energy production. In 2018, further examination of eliminating carbon dioxide from industrial and other sectors globally will be forthcoming.

This is the context of technological possibility, and the competitive economic advantage of zero fuel cost and zero emissions renewable energy for the pursuit of global sustainability and 3 tons of carbon per person per year as an achievable goal combined with global cooling activities to remove carbon dioxide from the atmosphere by soil building and biomass.

But technological possibility and economic advantage will not by themselves overcome the self-interest of polluters, the political inertia against dramatic change, and the trillions of dollars of soon to be stranded investment in fossil fuel and nuclear plants. To stranded plant is added the booked value of trillions of dollars

of fossil fuels in the ground soon to be rendered worthless as fuel. Current economics is driving the abandonment of fossil fuels. This is why in March 2018, Duke Energy announced the closing of 9 more coal plants to be replaced by renewables and, alas, natural gas. When southern utilities in the U.S. like Duke and Florida Power and Light turn big-time for renewables, they clearly are driven by economic reality.

Three tons is meant to be a call to local action to start where we are, to push as hard as we can for a renewable energy transformation and transformation of the global

industrial system to sustainability. This is happening on all levels from the efforts of Norenda Modi that is quickly allowing India to join China as a renewable leader, to efforts by U.S. States like California and New York in response to the Trump administration withdrawal from the Paris Climate accords. Like Governor Brown in California, we cannot wait for deliverance. We must act where we are and make that action part of a global wave of local plans and clear plans and demands to facilitate the grand global renewable transformation.

The Energy Watch Group writes that they "initiated this research to present an energy transition pathway encompassing all countries globally which is required for a comprehensive discourse on national government levels." The purpose of 3 tons of carbon per person per year is to raise these issues from below, through local plans, local demands that engage their neighbors, local businesses, schools, institutions and their political representatives. It is bringing the possibilities for a renewable transformation to reality.

We will sink or float together. We must make sure that a minimum of 1% of global product, annually \$1.1 trillion, raised through ecological assessments on pollution and high energy consumption is targeted for investment to helping the poorest pursue ecological paths and not fossil fuels. China and India, led by Xi and Modi, are already leading the way with trillion dollar renewable investment construction programs.

Globally, the renewable transition will require many trillions in productive investment, the everyday practice of making economic growth meaning ecological improvement. Much of this productive investment is to replace highly polluting and inefficient devices with more efficient and much less polluting machines, for example, installing only air to air heat pumps in buildings and not oil or gas burners. The three times more efficient electric heat pump, is a big money saver that slashes carbon pollution. It takes heat from the air, even in the winter. It is 3 times more efficient than oil or gas burners because of

the second law of thermodynamics advantages of the Carnot refrigeration cycle. In this case, heat pumps cooling the air and dumping the heat into the house in the winter. In the summer it takes heat out of the air in the house and dumps it outside. This is three times more efficient than burning oil or gas for heat. And if the electricity is from renewable energy sources, carbon dioxide is slashed to minimal levels.

A carbon-based fuel when burnt combines with oxygen to produce 3.15 times its weight in carbon dioxide. Burn 1,000 gallons of fuel oil for heat



Footprint. <http://bit.ly/LibGuides-Mm>

Cont'd on p.24

Sequestering Carbon in Our Forests

CARBON SEQUESTRATION: A COMMUNITY-BASED PROJECT TO REDUCE CARBON DIOXIDE AND GLOBAL WARMING

Lynn Peterson



Left: View of forest in the Green Mountains.

Vermont's hillsides are bursting forth in brilliant green! And the green color comes from chlorophyll, an enormous tool for removing carbon dioxide from the air, combining it with water and turning it into oxygen and carbohydrates. Both the beauty and the chemistry are truly amazing.

Beyond the exhilarating feeling lies a crucial element in our struggle to preserve the natural world by reducing atmospheric carbon dioxide and its role in global warming. Scientists and public officials have so far focused primarily on reducing emissions of carbon dioxide to prevent dangerous global warming. Evidence more and more points to the importance of photosynthesis to sequester carbon dioxide, thereby removing it from the atmosphere. A group of 32 leading scientists from all over the world authored an article in the prestigious Proceedings of the National Academy of Sciences claiming that forests, properly managed, could reverse the trend to a catastrophic rise in carbon dioxide.

Interest in using forests to reduce carbon dioxide levels has existed for years, and programs exist to provide economic incentives for these efforts. The Nature Conservancy has advocated this approach and has recently reported that some 300 programs in sequestration currently exist. To be successful, large tracts of forest, in the range of thousands of acres, are needed. This is more than that owned by most individual landowners. But larger tracts become possible when landowners collaborate or when public lands are used.

Fortunately, in Woodstock, Vermont, we had an organization dedicated to promoting activities that reduce the risk of environmental harm, Sustainable

Woodstock. By using this existing resource as a platform, we began a series of community presentations around removing or sequestering carbon dioxide. We turned to the Marsh Billings Rockefeller National Park, a local institution, and they agreed to host a series of meetings on sequestration.

The first presentation was given by a University of Vermont forestry professor who has been studying carbon sequestration. His findings show that existing, older trees can sequester a significant amount of carbon (it had been previously assumed that older trees were not as actively growing so would not produce much new wood). He also described two current approaches for funding sequestration and options for measuring it.

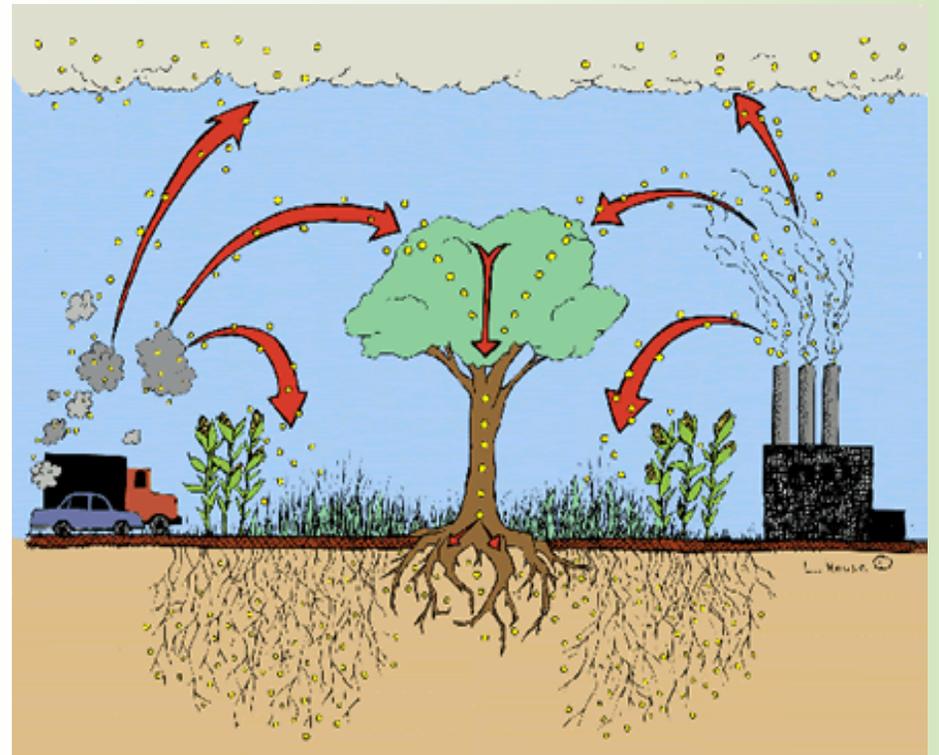
Our second meeting addressed George Perkins Marsh, Woodstock's legendary nineteenth century environmentalist and a namesake for the park. Marsh's pragmatic view of man's interaction with nature would seem to favor projects like sequestration which promise to improve habitat and human welfare.

Next, local foresters and a private landowner described their experiences working and living in Vermont's green mountains. Both private and public forest lands face challenges (e.g. declining forest products industry, invasive species, avoiding fragmentation, etc.), but people who live here appreciate its beauty and practical value.

At our fourth meeting, a Vermont official talked about the Regional Greenhouse Gas Initiative (RGGI) which had just completed its tenth year and produced about \$7 million for the state of Vermont. The nine states joining in RGGI receive financial compensation for reducing greenhouse gas emissions from electric power plants. We wondered whether this was a model for funding sequestration efforts.

A representative from the National Park Service spoke at our next meeting. She talked about current programs in the national park system as well as what's currently going on in Vermont. Wildlife habitat, tourism, and invasive species are programs being addressed by the Park Service.

Four more meetings are scheduled for presentations on state forests, the role of fungi in forests, experiences in manag-



Source: ERS/USDA

The Forest Center at Marsh Billings Rockefeller National Park was the host of the series of meetings on sequestration in Woodstock, VT. Photos: Lynn Peterson.

ing forests for sequestration in Maine, and, finally, a return of the University of Vermont's forestry professor to continue the conversation regarding options for us in Woodstock, Vermont.

Two kinds of science bear on these efforts to explore options for carbon sequestration. One is an older, more traditional view of environmental science which is mostly descriptive and focuses on understanding what currently exists. The other is more interventional and focuses on the future and what might be done to improve it. This later view represents the kind of program advocated in education circles, called STEM. The emphasis on science, technology, engineering and mathematics is relatively new in environmental work but has been flourishing in medicine for the past 50 years. Lessons from that realm of applied biology show the importance of informed consent and engagement of a wider community to approve projects. While in-

formed consent seems irrelevant, community engagement seems even more important in environmental science: alterations in the natural world have more obvious and widespread impacts on large numbers of people. Existing community groups, like Sustainable Woodstock, are one way of ensuring public engagement.

So we intend to continue conversations beyond these talks and come up with plans for enhancing forest capacity for sequestration. Wouldn't it be wonderful if we could use Vermont's forest to reduce the risk of catastrophic warming and at the same time enhance its natural and aesthetic value?

Lynn Peterson, MD retired to Vermont after practicing surgery, teaching and doing medical research for 40 years. Lynn has turned his attention to the environment, gardening and caring for 103 acres of forest while serving on healthcare boards and committees. ♻️

The Outside Story: Emerald Ash Borers

Declan McCabe

Jim Fuller, a former park ranger at Vermont's Grand Isle State Park, described this interaction with a tourist from New Jersey, when he confiscated their out-of-state firewood.

Ranger Jim: "We are trying to keep the forests clear of invasive insects."

Tourist, as beetle fell from firewood: "you mean like that one there?"

In this instance, the hitchhiking insect proved to be an innocuous flathead borer. However, Jim's anecdote illustrates a major challenge for forest stewards around the region, and especially for officials tasked with managing tourist areas.

Invasive insects often hide in wood. Every time someone moves firewood from one area to another, especially when they transport it over long

distances, there's a risk of a new forest infestation.

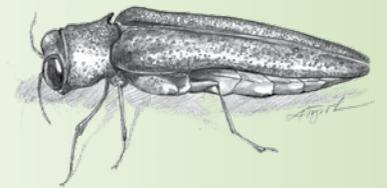
The emerald ash borer (EAB) is a poster bug for this risk. Recently, this highly destructive half inch long metallic green beetle has reached Orange County, Vermont, and transported wood is one of the potential causes. EAB kills all American ash species, and in our region's forests, where white ash is common, the insect has the potential to bring about radical change in our ecosystem and loss of timber value, as well as die-offs of yard and street trees. According to State Entomologist, Judy Rosovsky, the Orange County infestation was noticed by an observant forester working on private land. He sent photographs to vtinvasives.org, and they were able to confirm his suspicions.

The time between first infestation and

tree death is remarkably short – typically, one to four years. The damage occurs as larvae chew their way through the tree's sapwood, zigging, zagging, and leaving frass-filled serpentine pathways in their wake. As they sever vessels beneath the bark, the effect is similar to someone ringing a trunk with a saw.

Part of the challenge of managing EAB, is that it is hard to detect, especially in the early stages.

Generalized symptoms of ill health in ash trees such as crown dieback are often early signs, but other conditions can also bring these same symptoms. A frequently cited diagnostic is the one eighth inch, D-shaped hole that an adult beetle leaves as it emerges through the tree bark (adults emerge between May and midsummer). However, in practice, these holes can



be very difficult to find and identify. When Rosovsky and her colleagues are inspecting an area, "we look for woodpecker's pecks and flecks – flecks of blond bark where the birdy feet have kicked off bark, and pecks just into the wood, where the insects hang out."

Approximately five percent of Vermont's trees are ash, so I feel some stress at the news of EAB's arrival (one small consolation – mountain ash, a beautiful tree of high elevations, is not a true ash and is immune). However, as my father liked to say, "if you must panic, have an organized panic," and so I asked Rosovsky how

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A Fertile Opportunity for Renewable Heating

OLDER COMMERCIAL BUILDING BENEFITS FROM BIOMASS HEAT

Scott Nichols

Sometimes nice old buildings present fertile opportunities for renewable heating makeovers with Froling wood pellet boilers. Here is a great example. The building that became Tarm's headquarters was a 30,000 square foot office, and the warehouse was built in stages starting in 1965 by New Hampshire Governor Meldrim Thomson for his Equity Publishing business. As Governor in the 1970s, Thomson's business grew from the core 1965 building, and each building addition received another heating system. When Tarm Biomass moved into the building almost two decades after the Thomson family owned it, there were six separate heating systems.

The original equipment included:

- The original, blackened, American Standard oil boiler with its six inch stalactite pipe leaks.
- Three propane-fired rooftop units redundantly heating office space also heated by the oil boiler.
- An oil-fired furnace array hanging from the ceiling of the 1986 high cube warehouse.
- An oil furnace (dubbed Frankenstein) heating another 10,000 square feet. Based on oil stains and soot coatings, Frankenstein appeared to be at least 40 years old.

The Makeover Begins

When Tarm Biomass moved in as a tenant, the new building owners saw an opportunity to hire Tarm to update and simplify the heating system with a new, renewable heating system that would use Froling wood pellet boilers. With winter approaching in 2016, Tarm Biomass began a thermal makeover. They started by breaking the old American Standard cast iron sections apart and carting the soot- and mud-filled beasts to the scrap heap. Tarm then built a new distribution manifold and installed a Viessmann propane boiler where the oil boiler had been. While serving as the primary heating source in the winter of 2016-2017, the propane boiler became a backup heat source for the future.

Where the Frankenstein furnace once



Above: The original, blackened, American Standard oil boiler with its six-inch stalactite pipe leaks. Right: Two new Froling wood pellet boilers, 350,000 Btu/hr each replaced the old inefficient heating. Photos: Scott Nichols.

lived, two new Froling wood pellet boilers, 350,000 Btu/hr each, were added. A 1,250 gallon buffer tank was installed in the adjacent warehouse. The boiler installation space was chosen due to its proximity to an outside wall, allowing pellet delivery truck access and a simple chimney installation. A 15-ton-capacity pellet silo was placed just outside the new boiler room. The Froling wood pellet boilers pneumatically pull fuel through 2-inches hoses from the silo as needed, which make it unnecessary for building staff ever to handle the fuel.

These wood pellet boilers work automatically in a cascade to heat the buffer tank. Consequently, as the buffer tank drops in temperature, each boiler responds as needed to keep the tank hot. There is a Grundfos Magna circulator that automatically responds to building demand by measuring the difference in supply and return temperature. When there is a call for heat, the Magna pushes heat to the building heating-load automatically. Through flow modulation, the Magna not only saves power but also helps the buffer tank store thermal energy more effectively. Replacing the Frankenstein furnace

with two new air handlers connected to the Froling wood pellet boilers was easy. Now, approximately 20,000 square feet are heated with wood pellets. Read more at <http://bit.ly/Froling-auto-boiler>.

Funding Opportunities

Using wood pellets presented several opportunities. First and foremost, the State of New Hampshire, through the Renewable Energy Division of the Public Utilities Commission, provided a generous, 40% rebate payment of just over \$58,000. The United States Department of Agriculture also helped with a Rural Energy for America (REAP) grant of around \$20,000. REAP information is available at <http://bit.ly/REAP-RE-grants>.

Thermal Renewable Energy Credits

Until at least 2025, the building owners will be able to sell thermal renewable energy credits (T-RECs). T-RECs are marketable commodities which are worth about \$22.50 per megawatt hour (MWh). T-RECs are created by New Hampshire law, which requires power generators to produce a certain amount of energy with renewable sources. If generators cannot produce their own renewable energy, they must purchase renewable energy credits. A certain amount of those credits must be purchased from the thermal class of available credits. Learn more at <http://bit.ly/NH-PUC-T-RECS>.

Tarm installed a heat meter, tallying energy produced by the pellet boilers and uploading that data to a website. The

output data is verified by a qualified third party auditor. Though the final quarter of 2017 was a warm period, the building owners generated 20 MWh's of thermal energy, which was worth about \$450.00 after paying a fee to a T-REC aggregator. Based on fuel use predictions, the building owners expect to earn between \$2,000-\$3,000 each year selling T-RECs. Each ton of wood pellets generates approximately 4 T-RECs in efficient pellet boilers.

During the winter of 2017-2018, locally made wood pellet heat offset about 6,000 gallons of propane use. The building owners are already exploring extending heat from the wood pellet boiler system to the last remaining 10,000 square feet oil-heated space. Stay tuned for follow-up stories about fuel use and savings.

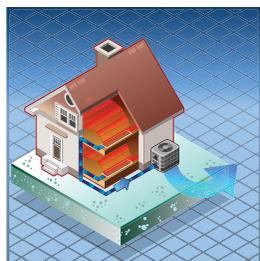
Scott Nichols is the owner of Tarm USA, Inc. located in Orford, NH. Learn more at www.woodboilers.com. 1-800-782-9927.



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VP NEGPA Wins NY-GEO Top Job Award

By Larry Lessard and Michelle Harrison (G.E.T. staff)



NEGPA's Vice President and 2018 "GeoStar Top Job" award winner, Larry Lessard (center), with John Manning (left), NY-GEO Board Member and President of Phoenix Energy Supply, and Jens Ponikau of Buffalo Geothermal (right), 2017 award winner. Photo: NY-GEO.org.

The 2018 NY-GEO conference drew an international crowd of more than 300 people. The presentations and vendor exhibits were informative. A highlight of the conference was the fourth annual "Geo-Star Top Job" competition, which included five finalists. NEGPA's (New England Geothermal Professional Association) Vice President, Larry Lessard, of Achieve Renewable Energy in Salem, MA won the competition! The winning project was the conversion of a 19th century mill building in Arlington, MA to a 21st century technology incubator.

Arlington Center Garage and Service Corporation, the owners of the mill, were undertaking renovations of the timber and brick structure. The first floor was vacant, and Glance Networks, a technology company, occupied the second floor. The goal



Installation by Achieve Renewable Resources of a ground source heat pump system at a 19th century mill building in Arlington, MA. The ground source consisted of eight vertical bores.

was to create a bright and inviting Class A office space on the first floor with multiple private offices and open work areas. This space was built for WorkBar, a regional, technology-focused workspace sharing company. Maintaining a short schedule to meet WorkBar's move-in date was a key to project success.

A major part of the mill's renovation was upgrading the HVAC system. The building was heated by a fuel oil-fired steam system which was replaced with a ground source heat pump (GSHP) system. Achieve Renewable Energy, LLC (Achieve) installed the GSHP. The GSHP system was chosen to meet the owner's goal of reduced carbon emissions and lower operation costs.

There were permitting challenges for the project, as the project was within a wetland resource area. The available space for the ground source required crossing Mill Brook and a large sewer main. Achieve devised a method for pipe routing and obtained the required special permits.



Before (top) and after pictures of the mill showing renovations of the timber and brick structure. Images: Larry Lessard.



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The ground source consisted of eight vertical bores drilled in diorite and gabbro. Each boring was completed with a 1.25 inches diameter HDPE u-bend and backfilled with graphite-enhanced grout with a thermal conductivity of 1.6 Btu/hr-ft-°F. The borings were plumbed in parallel in pairs and combined in a pipe vault. From the vault, four inches diameter piping traversed the sewer main and brook.

Achieve installed variable-speed, central loop circulation that supported six WaterFurnace GSHPs. Three of the GSHPs utilize variable-speed compressors and condition up to six zones each. The other three GSHPs utilize two-stage compressors and support up to four zones each. The first floor design alone had 18 zones. The building has 24 zones. Each GSHP is monitored remotely using a WaterFurnace Aurora Web-Link (AWL).

Construction was completed on time,

and the renovated facility opened to great fanfare. Based upon data from the AWLs, for the 12 months from March 2017 through February 2018, the approximately 12,000 sq. ft. historic building had total heating and cooling cost of \$6,415 at \$0.18/kWh. Of this, about \$1,500 was cooling of a server room.

The mill owner commented that this is the lowest maintenance, quietest and lowest operating cost heating system at any of their numerous facilities. The GSHP system has been expanded as WorkBar expands. Achieve is now involved in a GSHP at the adjacent, larger mill building for the same owner.

Congratulations to Larry and his team at Achieve on their winning project!

Larry Lessard is Vice President of NEGPA and Director of Achieve Renewable Energy, LLC. ♻️

New Product to Heat or Cool Homes: 'Dandelion Air'

Most of us know a company called Google, which is a subsidiary of Alphabet. Another Alphabet subsidiary is Dandelion, which arose out of X, Alphabet's research and development laboratory.

Dandelion launched a new product system, the Dandelion Air, on May 30. The Dandelion Air is a smart, all-in-one home heating and air conditioning system. In terms of converting electric power to heat, it is over four times as efficient as any furnace on the market. It is also nearly twice as efficient as a conventional air conditioning system. The Dandelion Air is so efficient because it is a geothermal heating system.

The Dandelion Air is being sold for less than \$20,000, about half the cost of a traditional geothermal installation. The company also offers no-money-down loans, with payments starting at \$135 per month over a 20-year term. Typical homeowners who switched from heating oil to the Dandelion Air for no-money-down are expected save approximately 20% annually on the cost of heating and cooling their homes.

Unlike a conventional fuel furnace, the Dandelion Air is safe, smart, and low maintenance. Because it is fuel-free, the Dandelion Air eliminates risk of carbon

monoxide poisoning and improves indoor air quality. The Dandelion Air comes as part of a complete Dandelion Home Geothermal System. The complete system includes the installation of underground pipes, a buffer tank for hot water, a Nest Learning Thermostat, and a smart monitoring system. The system's smart features ensure the system is running with optimal efficiency and homeowners will save as much money as possible over time. The system has low maintenance and has a life expectancy of at least twenty years.

Dandelion chose AAON, a heat pump manufacturer with over 30 years of HVAC manufacturing experience, as its production partner. AAON water-source heat pumps provide heating and cooling to tens of thousands of buildings. The company employs over 2,000 people in the United States and is headquartered in Tulsa, Oklahoma.

"We're thrilled to partner with AAON on the Dandelion Air," said James Quazi, co-founder and Chief Technology Officer of Dandelion. "AAON uses state-of-the-art automation technology for precise, time-efficient production of each unit. Together, we will continue to drive up quality and drive down costs of home geothermal heating and cooling."

Dandelion has also partnered with top tier residential HVAC installers across New York State to install the Dandelion Air. Homeowners can see if their home is eligible for the Dandelion Air and connect with a local Dandelion installer at www.dandelionenergy.com. ♻️

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New England Geothermal Professional Association
- congratulating its vice president Larry Lessard for winning the 2018 New York Geo Top Job award.

CLIMATE TRUTH: A PLAN

Cont'd from p.20

releases 22.4 pounds of carbon dioxide per gallon according to the EIA or 10.15 metric tons of carbon dioxide a year. Electric heat pumps today reduces that to 3.4 tons and to a small fraction of that if the grid was renewably powered. The heat pumps could be sold by your electric utility on a no capital down basis and paid for from the savings from the fuel you no longer consume.

WHAT TO DO

What's a concerned citizen to do beyond just worrying about business and pollution as usual that is leading us to common catastrophe? Suppose you knew that your personal share and entitlement for carbon dioxide emissions was three tons of carbon dioxide equivalents a year to hold the amount of carbon dioxide steady in the atmosphere. And you also knew, for example, that an average gas driven car emitted 4.7 tons of carbon dioxide per year and an electric car would cut that in half even when powered from the current polluting grid, and much, much less on a life cycle basis from a future global efficient renewable energy system displacing almost all fossil fuels.

Carbon dioxide life cycle footprint of fossil fuels is much greater than just the combustion. Included in life cycle carbon are substantial methane leaks from natural gas production and pipelines, the energy for drilling, mining, transport, refining, and disposal that are much more significant for fossil fuels and nuclear energy than for renewables. Reducing end use of fossil fuels has a much broader effect on net emissions.

A plan to help get to three tons is not simply to buy electric cars, but also to improve public transportation, bike sharing, installing electric vehicle charging infrastructure and car to home interconnection for millions of EVs to also help provide power into the electric grid, mandate phasing in of electric vehicles whose operating "fuel" cost is equivalent to less than \$1.00 per gallon.

Understanding your current average national contribution in tons of carbon per person per year is the basis for understanding and changing not just your personal choices, but your local and national systemic issues necessary for getting to sustainable carbon levels.

Three Crucial Steps for Getting From Endangered Present to Ecological Future

An ecological transformation is not a recipe for stringency and poverty. It is a strategy for improved efficiency and massive productive investment over time to create a sustainable global energy, production, agricultural, and forestry system. This is a recipe for a global convergence on sustainable conduct. It is the basis for a plan for social and ecological justice and an end to poverty.

Technologically, a comprehensive and economic series of changes are available to transform the self-destructive industrial present to make economic growth men ecological improvement in the context of a global pursuit of social and ecological justice.

A family of four today as an interim step with a 12 tons of carbon per year entitlement and goal could quickly move from 14.9 tons carbon for car and heating to 7.1 tons with electric vehicle and heat pump even using the current grid. A wide variety of measures can replace the typical U.S. consumption pattern and become part of the ecological transition plan including car sharing, public transit, telecommuting



A sustainable earth. Image: Pixabay

and living near your work, bike sharing, autonomous electric vehicles for hire.

At bottom, once we look the three tons of carbon challenge in the eye, it's a straightforward matter to develop a clear plan in steps to get from our polluting and self-destructive present to a sustainable ecological future.

Three numbers matter the most that serve as a personal and collective guide to solutions from the grassroots up. We can have much more power to help change what happens in our neighborhood and our town and state than we do nationally and globally. Yes, millions of people in the streets can help move the global leadership. But we have the real chance to participate in developing local plans for our town to take steps to:

1. Inventory and understand our greenhouse gas emissions from all aspects including individual and industrial consumption but also from agriculture and from forestry. There are good free software tools now available to conduct an inventory including the Global Protocol for Community Scale Greenhouse Gas Emission Inventories. This 170 page report that provide detailed guidance and tools for conducting greenhouse gas emission inventories and developing and verifying plans http://www.ghgprotocol.org/sites/default/files/ghgp/standards/GHGP_GPC_0.pdf.
2. Develop comprehensive plans to climate change mitigation focused on reaching the 3 tons per person carbon dioxide limit asap and to remove and sequester carbon from the atmosphere through soil building and biomass growth to provide global cooling and eventually return the atmosphere to pre-industrial carbon levels below 300 parts per million.
3. Have an action plan for implementation of the plan on financial, legislative, technical, legal area. Understand what must be done and what tools do we need to make this happen. For example, to retrofit all buildings with PV and efficient appliances and EV charging capability could be facilitated by a combination of revolving loan funds from local revenue bonds providing loans to be repaid from the stream of saving from efficiency and renewable energy products. The measures needed will encompass the political, regulatory, technical, and financial areas.

Facing Reality and Shaping an Ecological Future

Three tons of carbon dioxide per person per year as goal and guide is the basis for more than typical climate change mitiga-

tion and adaptation plans. It is the basis for community action and beyond to craft a sustainable, prosperous, ecological and just future.

Three tons of carbon per person per year as global target for yourself, your city, your state and beyond is the basis not only for stopping and reversing climate change. It is the means for pursuing ecological economic growth, building locally owned assets in the renewably powered economy and for the pursuit of social and ecological justice manifested in concrete plans and to take action as consumers, workers, business people, investors, neighbors.

Sustainability writ large is the expression of grand co-evolutionary forces that have shaped our planet and the ecosphere. This has created the oxygen atmosphere with just enough carbon dioxide to maintain surface temperature within a range not too hot or too cold. The history of the co-evolution of life and planet Earth has been one of countervailing and healing response to excess that has permitted life to both survive periodic crises and mass extinctions and to respond to changing conditions and once again thrive.

We are in the midst of one of the times of crisis and the potential for a mass extinction event, this time driven not by geologic action like volcanoes, but by human industrial action and conscious human action. Humanity has joined the global process of sustainability that reshapes the nature of Earth on a fundamental and geological scale.

Humanity has the ability and the necessity, to play a healing role in response to industrial excess and toward the development of a sustainable civilization that will endure for geological time scale. If we fail we are almost certain to suffer the consequences of ecological and social crisis for geological scales potential lasting for hundreds of thousands of years as did the global warming of the Eocene.

We need to choose between pursuing a sustainable ecological future or accept decent into ecological chaos. Three tons of carbon dioxide per person per year is a means and a guide for healing and enduring ecological change and building a prosperous and enduring ecological civilization. Choose wisely. Now is the time.

Roy Morrison's latest book is *Sustainability Sutra* (Select Books, NY 2017). He is currently working on installing solar on working farms www.dual-cropping.com.

References will be available with the posting of this article on the Green Energy Times website at <http://bit.ly/GET-green-growth>. ♻️

Royal Sustainability...

Cont'd from p.1

time. In 1990, Prince Charles, founded Duchy Originals. Now run by Waitrose, the business sells organic food in stores all over the world.

Much of the power for Windsor Castle, the royal wedding between Prince Harry and Meghan, and the E-Type Zero, comes from a pair of Archimedes screw water turbines that the queen had installed on the River Thames in 2013. No wonder Adolf Hitler called the Queen "the most dangerous woman in Europe". As he bombed England, the Queen Mum and the current Queen stayed in the country, facing the same risks as common folk. They lead by example.

On a larger scale, Britain and the UK have become leaders in offshore wind, solar and biomass power development. Nearly 20% of their power now comes from renewables, with a target of 30% by 2020. The Scottish center for offshore wind development is a world leader in turning offshore oil technologies to offshore wind systems. In transport, London has banned diesel vehicles in East London starting in 2018, and by 2040 Britain will ban sales of all petrol based vehicles country-wide. Jaguar and other British car companies are announcing their transition to electrified vehicle models.

Europe is being just as aggressive to clean up their act. Several cities have acted to ban diesel vehicle use within their city; Rome by 2024, Dusseldorf and Stuttgart by 2020. Paris, Madrid and Athens are making plans to ban petrol cars in the city centers by 2025, among others. A few European countries have announced their intent to ban all petrol based vehicle sales by 2040-2050. The world-wide leader in electric car adoption is Norway with 30% of 2016 car sales being electric, almost 40% in 2017, and reportedly over 40% so far in 2018. Both Norway and Britain have substantial interests in the fossil fuel business, yet recognize the need to clean up energy with policies to transition away. All Europe is aiming to reduce its hydrocarbon emissions by 80-90% by 2050, with a target of 27% by 2030. Europe is guided by the Intergovernmental Panel on Climate Change (IPCCC) science and remains as firm adherents to the Paris Agreement. They get it, too.

While the U.S. struggles with successful but fragmented sustainability efforts, our policy backing is missing. The UK and Europe are stronger in both policy and effort. They are leading the way right now, by example, not us.

Randy Bryan is one of the co-founders of *Drive Electric NH*. Randy has been an advocate for electric cars for eight-plus years. His company, *ConVerdant Vehicles*, has converted vehicles to plug-in hybrids, including his own Prius in 2008, and developed and sold inverters that turn a Prius into an emergency generator.

George Harvey is a staff writer for *Green Energy Times* and writes the *Energy Week* blog. George hosts the weekly show *Energy Week on Brattleboro Community TV*. The hour-long program is packed with news and information about energy and global warning.

Queen Elizabeth when she was a truck driving princess.
Image: Public Domain



Our Responsibility to the Earth

Dr. Alan K. Betts



Spring came late this year, as the daffodils did not start opening where I live in Pittsford, Vermont until April 18, and the forsythia were ten days later. Rain

for days on end from slow moving weather systems led to substantial flooding. The grass grew profusely weeks before it was dry enough to mow. I planted cool weather crops, lettuce, kale and broccoli by the first of May, and by the beginning of June, even the summer squash and tomatoes were growing fast.

Earth Day was a Sunday this year. In the morning, I spoke at the Dorset Church about our failing to accept our deep responsibilities to the Earth. In the afternoon, I spoke to a group called Earth Matters on the green in Manchester, Vermont. The challenge we face is the same whether framed in spiritual or secular language: time is running out for humanity if we continue down the path of mindlessly exploiting the Earth for profit.

The glaring question facing us all is the following: Who is responsible for solving this mess?

In early May, I spent a week in the mountains of Alberta, Canada speaking to an international meeting of hundreds of scientists working on global water and energy issues. The title of this open science conference was "Extremes and Water on the Edge." Introducing the conference, the Deputy Minister of Environment and Climate Change Canada explained how fast the Canadian north is changing as ice, snow and permafrost melt. Planning for the future is well underway, but the adaptation costs are immense. Ironically, Alaska has just the same changing climate but

planning is very difficult, because federal policy requires them to pretend it isn't happening!

As the climate changes, so the global water and energy cycles are changing. The long-frozen north is melting, and floods, droughts and heat waves are becoming more frequent across the globe. Disaster response and future planning for resilience were hot topics. Scientists are in no doubt about what needs to be done to move away from a fossil fuel economy to a renewable energy economy, but, traditionally, scientists have preserved the integrity and independence of science by leaving policy to others. My message to this scientific community was that we have a moral obligation to Earth, especially earth scientists who can see clearly the dire future that lies ahead under 'business as usual.'

This moral responsibility, of course, extends to all of us. It is time for citizens and professionals to speak up for the interests of all our children and life on Earth. We can no longer leave issues of 'policy' to a federal government that is simply ignoring all that we know about the climate system in order to protect the massive investments of the fossil fuel industry (who are bribing them).

Across the U.S. and on a global scale, the renewable energy transition is going nowhere near fast enough to stave off disaster. The Earth's energy imbalance is about 1.3 watts per square meter, and 93% of this extra energy is being stored in the oceans for the decades and centuries to come.



"Blue Marble," January 4, 2012. Image from NASA.

This may seem small, comparable to a LED night light, but it is about 250 times as large in total as the entire global electrical energy production. Rising sea level comes from this heating of the oceans, along with the melting of glaciers, which puts all our coastal development at risk. The flooding of New York by hurricane Sandy illustrates what happens when warmer seas give stronger storms with powerful storm surges along with higher sea levels.

So redouble your efforts for the renewable energy transition. Work together to build creative synergistic solutions that will work for everyone, because so much is at stake and discuss openly the moral issues we face with your colleagues and neighbors.

Dr. Alan Betts of Atmospheric Research in Pittsford, Vermont is a leading climate scientist. Browse alanbetts.com.

NEWPORT, NH TO ACHIEVE NET-ZERO ENERGY STATUS

Cont'd from p.14

this type typically help attract and retain forward-looking commercial and industrial companies and industrial businesses," said Norwich Solar's CEO, Jim Merriam. "We applaud the real leadership Newport has shown, as well as the cooperation by the facilities department, School Board, School Superintendent, Select Board and voters to make this marquee project a reality."

Norwich Solar Technologies representative Don McCormick, who has managed the project for the past year said, "In addition to the long-term energy savings from this multi-million-dollar project provided at no cost to the town, there are the added benefits of protection from volatility in an unstable electricity market, energy independence, contributions to a clean energy economy, and educational opportunities for school STEM programs."

Learn more about Norwich Solar Technologies at norwichsolar.com.

Newport, New Hampshire was incorporated in 1761 and has a population of 6,500. It is governed by an elected five-member select-board and an appointed town manager. Newport also serves as the county seat of Sullivan County. Learn more at newportnh.gov.



Downtown Newport, NH. Wikipedia

COAL IS JUST BAD, BAD, BAD

George Harvey



Merrimack Station. Photo: SayCheeeeese, Wikimedia Commons

The President wants to save coal and nuclear plants from closing, citing security issues. One estimate in the Caspar Star-Tribune, published in Wyoming, where coal is still king, said the cost of subsidies could be as high as \$30 billion. (bit.ly/ST-coal-relieve) The reason why the plants are closing is that both coal and nuclear power are much more expensive than wind or solar.

Lazard Associates provides what may be the most widely quoted financial

The experience of the 100-MW Hornsdale Power Reserve (HPR) suggests that batteries can earn money for backup power, even in the absence of renewable energy. The HPR was so successful that the amount of money it saved in the first four months of operation was 70% of what it cost to build it. Batteries that might back up wind and solar power are not money losers, they are money makers, because they also provide the backup needed for baseload power.

advice on the levelized costs of electricity, in which costs of subsidies and incentives are included. Their cost range for wind power as \$30 to \$60 per megawatt-hour (MWh), and the cost for utility-scale solar at \$43 to \$53 per MWh. By contrast, the cost of coal is given as \$60 to \$143, and for nuclear at \$112 to \$183. (bit.ly/LCOE-11)

Coal is very dirty, and this creates economic problems. An example of coal's damage is Lake Champlain's once thriving fishing fleet. It was put completely out of business by a by-product of the coal industry, mercury, which made the lake's fish unsafe to eat in any quantity.

A study published in the important British medical journal, The Lancet, in February concluded that one out of every six people who die prematurely do so because of pollution. (bit.ly/Lancet-pollution) The losses include about 9 million deaths each year, worldwide. The economic losses amount to \$4.6 trillion per year, or about 6.1% of the world's gross economic output.

According to an article in the June, 2017 issue of Scientific American, up to 52,000 Americans die each year because of particulate pollution, mostly from coal. (bit.ly/SA-particulate-deaths) The U.S. Department of Transportation, as cited in the Globalist, put the value of human life in this country at \$6,000,000 in 2011, though other agencies had the figure much higher. (bit.ly/cost-of-death) This means that the value of human life lost in 2011 was over \$312 billion in the U.S.

Against this we could put the 1.73343 billion MWh the Energy Information Administration said coal produced in 2011. (bit.ly/EIA-monthly) Dividing the \$312 billion by 1.73343 billion MWh gives us a

rough guess at the cost of lost human life per unit of energy, a figure pretty close to \$180/MWh, or 18¢/kilowatt-hour (kWh). To this we can add health costs of those who died and those who continue to live with the health problems caused by coal.

A detailed study cited by sourcewatch.org put the external costs of electricity from coal in a range of 9.36¢/kWh to 26.89¢/kWh, with a "best" estimate at 17.84¢/kWh. (bit.ly/SW-cost-of-coal)

When we add the external costs to its price, we find that the electricity generated by coal-burning plants may cost considerably more than twice what it is charged for it on the retail market.

The administration says we need to save our coal plants for the sake of security. The Federal Energy Regulatory Commission says this is wrong, and four of its five commissioners were appointed by Donald Trump. Electric utilities say it is wrong. Transmission systems say it is wrong.

Two federal agencies have identified serious security threats that could bring our grid down for over a year: terrorism and solar ejections. But coal and nuclear plants are useless when the grid is down; they provide no security. The way to address the problem of grid security is with renewable microgrids.

New Hampshire's First Multi-Family Passive House

Greg Whitchurch

Gilford Knolls III (<http://bit.do/GKIII>) will provide 24 affordable, one-bedroom apartments for seniors and will be New Hampshire's first multi-family dwelling to be built to the Passive House standard.

A passive building is designed and built in accordance with five main principles:

- Continuous exterior insulation to avoid thermal bridging.
- Nearly airtight construction to guarantee comfort and manage moisture.
- Extremely high-performance windows and exterior doors.
- Balanced energy-recovery ventilation and a finely-tuned heating and cooling system.
- Attention to solar gain to take advantage of the sun's energy in the heating season and planning for shading to minimize solar heating in the cooling season.

Lakes Region Community Developers (LRCD) of Laconia, NH is the developer of this project, and their Director of Real Estate Development, Sal Steven-Hubbard, gave me and another member of Vermont Passive House a tour of the facility in late May. Designed by architect Peter Stewart of Stewart Associates in Laconia, NH and built by Martini Northern of Portsmouth, NH, Gilford Knolls III will open in July. It features a spacious community room, on-site resident services, and recycling. Rents vary between \$670 and \$890, depending upon income, and includes electricity for heat, air conditioning, water, cooking, lighting, etc. - and it is ALL electric! (The laundry room is coin-operated.) In fact, the only fossil fuel on site is the tank for the big backup generator.

"This promises to be the first certified Passive House multi-family development in New Hampshire, which would be quite an achievement," said Paul Eldrenkamp of DEAP Energy Group LLC in Newton, MA, a certified Passive House consultant who supervised the construction effort. "The entire Gilford Village Knolls team has been on board from the beginning, has rolled with the punches, and is determined to meet the goal of certification. It's been a privilege to be part of this project."

Architect Stewart pointed out that he was unfamiliar with the Passive House standard, but with guidance from the Certified Passive House Consultant (CPHC), he learned as he went along and was able to meet the stringent design standards required. He's convinced that passive house is the way to go; he'd like to design more of them; and he recommends that other architects read up and learn about the goals and methods of passive house design.

GK III sports a \$300,000, 105kW rooftop solar array from ReVision Energy. Its 344 panels are expected to generate 109,700kWh of solar power each year. Harvesting New Hampshire's abundant solar resources will result in more than \$600,000 in electricity cost savings over the life of the array. On an annual basis, the Granite State receives 33% more sunshine than Germany, a world leader in solar energy capacity. Every year, the system will offset over 57 tons of carbon pollution from regional fossil fuel power plants.

Using Low Income Housing Tax Credits (LIHTC) the LRCD syndicates their projects



Gilford Knolls III in late May, 2018. The multi-family passive house is slated for occupancy in July, 2018. Photo: Greg Whitchurch.

keeping the debt low. The New Hampshire Housing Finance Authority administers the federal tax credits and awards them competitively. The LRCD then sells those credits to an investor in return for cash to the project. The LIHTC investor also bought the federal solar credits as a part of their investment. Using the solar PV, LRCD can lower the operating cost of the building through lower utility costs. The cash generated goes to paying off the loan that pays the capital cost of the PV.

"We commend Lakes Region Community Developers on their forward-thinking approach to this new facility. Making the investment in clean energy will significantly reduce operating costs while reducing reliance on fossil fuels," said Elijah Garrison, ReVision Energy solar design team manager. "The fact that the building will achieve the prestigious Passive House performance standard is incredibly impressive with a publicly-funded project designed for community benefit. The standard sets a tremendous example for what is possible, even in our cold New Hampshire climate and even with a tight project budget and timeline. As

a Gilford resident, I am incredibly proud to add this building to our community."

Through the use of state-of-the-art materials and techniques, this super energy-efficient building will use only about 35% of the energy that a comparable "code" building would use. Passive House rated high-efficiency windows and doors (from Schuco), generous insulation (fiberglass in the walls and cellulose in the ceiling), Passive House-level airtightness, and reductions in the thermal bridging common to standard building techniques make this possible. Fresh air is provided by RenewAire ERVs (energy recovery ventilators). Mitsubishi "minisplits" provide the heating and cooling for each apartment.

For more information about the Passive House standard, go to vtph.org.

Learn more about Revision Energy at RevisionEnergy.com.

Greg Whitchurch is a board member of Vermont Passive House and owner of a LEAF, a Prius and a net-zero passive house with solar PV and hot water in Middlesex, Vermont. <http://bit.ly/PHVT-Cottage>, (802)223-2416.



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A REAL HOME-GROWN, HIGH-PERFORMANCE DOOR

GRYPHON DOORS - KEEP YOUR HOME WARM AND TIGHT WITH MYCELIUM

Ben Graham

At the beginning of the last energy efficiency revolution that brought about Passive House, Living Building Challenge, Net Zero and Vermont High Performance Homes, it was widely reported that windows and doors accounted for around one-third of the loss of heat to most homes. Talk about low hanging fruit! Most builders began to learn about making building enclosures tighter and more insulating that included working out better details around places that are typically thermal breaks in the insulation layer such as window and door frames.

There was this issue though that it apparently takes a long time for large industries like window and door companies to respond to this shift in design. So builders who were looking for more insulating window and door products had a hard time sourcing good standardized products and often started looking overseas where they are typically ahead of our curve.

Seeing this opportunity, a small door company was formed to fill this demand specifically for the good old traditional wood door that was designed for the fossil-fuel free, carbon sequestering future.

I want to be clear, while the inspiration for Gryphon Doors is based on the beautiful wood doors we have grown up with, and that develop so much character as they age with the ones they protect, this is not your grandparents' wood door.

First of all, the standard Gryphon Door is three and a half inches thick. This reflects the shift to more insulation. With all that insulation the structure of the door has



Gryphon Door in Charlotte, VT. Photo: Ben Graham.

changed from a slab of not so insulating material - wood, to a sandwich design with the soft stuff on the inside. As you can imagine, these doors are a bit more substantial and require four solid hinges instead of the typical three.

The insulation used in Gryphon Doors is very important to the overall design, and distinguishes it from all other doors in the market. Not only does it use a lot more of it but it is a natural material that can be grown anywhere and does not require mining, drilling or energy intensive refining. The first insulation material used in the door core was

a revolutionary type of material developed by Ecovative Design from the Albany, NY area that involves mycelium. Mycelium-as in "the mass of branched, tubular filaments (hyphae) of fungi"- is grown in agricultural fiber based medium, such as hemp hurd, in a process developed to maximize the qualities for a stable, durable and insulative building panel. They began producing prototypes at their facility to be used in standard construction, and Gryphon Doors was able to support that process and incorporate some of the first Mycofoam panels into its doors. The Mycofoam panels are made by inoculating the hemp hurd with the fungus and storing that in a warm, wet place to grow. The mixture is then broken up and allowed to continue growing a second time to make the root system even stronger. The end of the process includes desiccating the panels to effectively kill the mycelium. The initial testing (ASTM C518) on the Mycofoam panels produced a thermal conductivity value of 0.039 W/mK = R 3.7 which is about as good as we have seen with agricultural fibers. Other testing showed that moisture levels remained stable with environmental fluctuations and tended to balance out at around 12%, and the water vapor permeation (dry cup) at 30, which we like, because it indicated that we will not be trapping moisture in our wood doors.

Gryphon Doors has also begun using sheep's wool-another agricultural type of fiber- as insulation. Sheep's wool is advantageous because of its high insulation value R 4.3(@1.13lbs/cf) as well as its resistance to water and fire, and its durability over time to stay in shape. Sheep's wool is also very light and complements the heavy wood structure. The other big difference is how the door



Cutaway of Gryphon Door with standard 3-1/2 in. thickness showing 2 inches of Mycofoam (R7.2) and double gaskets. Photo: Ben Graham.

closes in order to make not only a tight seal, but one that will last over the lifetime of the door. Again, this issue has been mostly solved with the advent of multipoint hardware and durable gaskets developed in Europe for patio door locks. A good air-sealing multipoint lock utilizes cam rollers to effectively pull the door tight against the seals to not only keep warm air from escaping but also to keep the wood structure in alignment with the seals and from sagging over time on its hinges.

These improvements to the classic wood entry door have brought it into the new millennium without losing the look or feel everyone is accustomed to. In fact, the heft of the

3 1/2" insulated door has actually improved the feeling of security and protection you get from using it. This is the explanation of the name: the mythical creature, the Gryphon, who is seen as a protector.

The Northeast now has a supplier of these insulated wood doors that are a perfect fit for our energy-efficient, fossil-fuel-free future.



Two inches of sheep's wool (R8.6) fills the door core. Photo: Jon Deerfield.

GOT A GREAT PRODUCT DESIGN? "GROW IT YOURSELF"

G.E.T. Staff

Suppose you were a mad scientist with an invention that required a specially designed box to provide insulation and strong cushioning for the materials it uses. Say, for example, you wanted to use liquid nitrogen to cool the peas you grow to -320° F instantly to keep them tasting as fresh as can be, and you needed to insulate the bottle the nitrogen is kept in. How do you get an insulated package for a special gas bottle at a relatively modest cost? You can get grow it yourself by following a simple recipe provided with Grow.bio hemp mycelium material from Ecovative Designs!

Reality check: It might not be terribly practical or wise to use liquid nitrogen in the home. But the words, "don't try this at home" do not apply to Grow.bio. You could actually use it to make a package to keep a wine bottle safe and cool, or a planter.

Grow.bio hemp mycelium material, originally called "Grow It Yourself," is a



blend of hemp hurds and mycelium that even beginners have had success with. The ingredients are available from Ecovative Design, and you can follow impressively simple steps to cook up the product of your dreams. Here is

Eben Bayer's recipe:

Ingredients: Agricultural by-products and mycelium (from Ecovative Design)

Also needed: A form or mold of the object to be made.

Steps:

1. Grind and cook the agricultural by-products according to instructions,
2. Inoculate them with the mycelium,
3. Put the combination into a form, and
4. Let the mycelium grow for 1 week.

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Learn more at ecovatedesign.com. Watch for full story about Ecovative Design in our fall edition of G.E.T.

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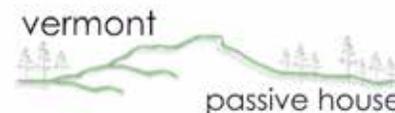


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Rebuilding After A Disaster

George Harvey

Carl Lavallee is the Chief Operating Officer at Wright Construction in Mount Holly, Vermont. He has some insights about disasters. He told us, "With a forest fire, what we see is huge devastation and all seems to be lost. But there is rebirth. In a house, a disaster may be an opportunity to rebuild in a sustainable way."

Lavallee has a number of points he would like to share. He relates these to the story of a woman who lost her husband and home to a devastating fire. It was so destructive to the house that nothing was left but the well and septic system.

Even the foundation was ruined.

Be conscious of your budget.

It is wise to plan for disaster. About 90% of the people who lost their homes in hurricanes last year did not even have flood coverage. Many of those who were flooded out had seen no need to buy insurance, because they were not even in 500-year flood zones. Even when disasters are covered by insurance, they are often not covered for the full cost of replacement.

In the case of Lavallee's example, the couple had recently retired at a relatively young age. The husband had taken care of all the finances, and the disaster forced our heroine to take on responsibilities that were largely new to her. This takes a different mindset, and it imposes a need to focus on the problems at hand during emotionally trying times. After a disaster, it is wise to be certain the professionals involved are also careful for your finances.

Build to suit your current and future needs, not your history.

There is a strong temptation to try to rebuild a happy life as it was. But many things a disaster destroys can only exist in the past. Though they can still be remembered, recreating them is probably out of the question.

This is true of the home, including its design. Our heroine had lived in a home

with five bedrooms. She really wanted to return to her old house, on the same land. That was financially possible. It was also not even close to necessary. What her life required, at least on the short term, was entirely different.



Another aspect of planning for the future is maintenance. Wright Construction suggested that the siding, roof, and layout of the home should be as easy as possible for a person who was likely to age in place. The roof was designed to be maintenance free during her lifetime, and the siding was chosen in part because it would not need to be painted. Fortunately, she agreed.

Keep an eye to resale value.

A redesign of the home could have been for a single bedroom, but that would have been unnecessary and quite probably even unwise. Extra bedrooms would not only accommodate guests but boost the future resale value of the home. We have to keep in mind the things that will make a home attractive to typical buyers in a given market, who might need two or three bedrooms.

Another issue was a walk-out basement that is ready to finish which was what she was used to and what she wanted. What little extra it cost would add greatly to the value of the house for adding useful rooms inexpensively.

Take best advantage of resources, both physical and aesthetic.

The old foundation was a loss. That meant that the new home would be built on an entirely new one and could be placed and oriented to take advantage

of both the sun and a lovely, sweeping view of the mountains. In some respects, the new home in the story could be superior to the old.

The new home was greatly improved with insulation and weather sealing. Carl Lavallee's work started with careful consideration of potential moisture issues. The cedar shingles, for example, sat on top of Cedar Breather®, a product of Benjamin Obdyke. This goes beyond shedding water, venting moisture out before it can get into the home. And though that product was designed for roofing, it was adapted to eliminate moisture penetration at the foundation.

The whole of the design, including insulation in the basement, walls, and attic, along with sealing insulated windows



A comfortable porch with a mountain view. Photos courtesy of Wright Construction.

and doors, was built to be as inexpensive as possible while meeting or exceeding the Vermont Residential Building Energy Standards. It is a comfortable, though not extravagant, place to live.

Wright Construction's website is www.wrightconstruction.com.

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Stuy Town: Innovations in Solar & Grass that Cities Can Embrace

George Harvey



Stuy Town Park. Image: Wikipedia. Inset: Lawn between high rise buildings before planting of Pearl's Premium Grass Seed. Photo by Jackson Madnick.

In the 1840s, a new source of energy was being employed in Manhattan. It was coal gas, a product created by heating coal with insufficient oxygen to burn it. Coal gas included hydrogen, methane, and carbon monoxide, all of which burn. It fueled street lights and was piped directly into people's homes for lighting and cooking. It was stored in large tanks along the East River, in an area called the Gas House District.

The Gas House District was not a great place to live, but in time, the gas tanks were removed. Just after the Second World War, the area, now two neighborhoods called Stuyvesant Town and Peter Cooper Village, was turned into a single large development called Stuy Town by its residents.

Stuy Town is one of the largest urban developments in the country. It stretches from 14th Street to 23rd Street, and from Avenue C to First Avenue. Its 110 buildings occupy 80 acres of land, and about 25,000 people live in its 11,250 apartments.

In 2015, Stuy Town was sold to Blackstone Group LP and Ivanhoé Cambridge, the real estate arm of pension-fund giant, Caisse de dépôt et placement du Québec, for about \$5.3 billion. The new owner decided to put \$10 million into a 3.8 megawatt (DC) solar array on 22 acres of the roofs of the buildings. When it is finished, it will provide enough power to cover the needs of about 1,000 apartments.

The generating capacity of the new solar array will be just about double what the entire Borough of Manhattan had when work began. The owners of the array say it is the largest multifamily residential rooftop solar project in the United States.

Stuy Town's previous owners had already started work on efficiency to reduce greenhouse gas emissions. LED lighting had been installed, special louvers were built for elevator shafts to reduce heat loss, high efficiency water heaters were installed, and new heating management systems were

put into use. Along with other measures, these efficiencies had reduced the greenhouse gas emissions from the complex by 10%.

Just as the rooftops of the Stuy Town buildings are getting a new photovoltaic system, its grounds are also being improved. Stuy Town is the home to a complex of city parks. They are comfortable, but they have some of the same problems that can be seen in many urban neighborhoods. With the tall buildings, there is not enough sunshine for many plants to grow well. In many shady areas in cities, most strains of lawn grass will not grow, and without care, the ground will be bare.

Readers of *Green Energy Times* may remember the August 2017 article, "Plant a Great Lawn and Save the Planet!" (bit.ly/GET-plant-a-lawn). Some of the benefits of really great grass are listed in that article, and among them are some of special importance in urban environments such as Stuy Town. And Pearls Premium Ultra

Low Maintenance Lawn Seed, featured in that article, was chosen for the lawns at Stuy Town.

Pearl's Premium Grass Seed is especially suited to growing in areas where the ground is constantly in the shade. It can also grow without any toxic chemical fertilizers or pesticides, only requiring a small amount of organic fertilizer; this makes it especially suitable for areas where children will play. Also, the Pearl's Premium grass develops four foot deep roots, reducing the amount of water that is needed by 75% and sequestering eight times the carbon as traditional grass to lessen climate change. This grass seed qualifies for LEED credits.

There are many aspects to efficiency. We talk often about reducing electric demand and eliminating fossil fuels. But it may be good to think more often about plants that grow in low-light areas, effortlessly absorbing carbon from the air.

NY-Getting the Job Done

Cont'd from p.12

In total, campaigns have saved participants approximately \$3.6 million in upfront purchase costs, for an average savings of \$1,476 per installation. The table shows the breakdown of Solarize projects by region.

Solarize brings together groups of potential solar customers, including low-to-moderate income participants, through widespread outreach and education to help customers choose solar companies that offer competitive, transparent pricing. The campaigns are managed by partnerships that include community officials, elected officials, municipalities and businesses. These partnerships help simplify the procurement and installation of solar panels and obtain discounts through aggregated purchases.

Campaigns generally run between six and nine months, including planning and outreach and serve as a complement to community solar projects, which increase access to solar in areas where residents may or may not own property or have room to install solar panels at their location. By educating the local community, streamlining marketing efforts, and aggregating customers, Solarize helps make solar a more accessible and affordable energy option for homeowners and businesses.

Households and businesses can subscribe to their local solar project and have energy delivered through their regular electric provider while the power produced from the solar array is fed directly back to the electric grid. As a result, the grid is supplied with clean, renewable energy while subscribers get credit on their electric bills.

The fourth round of campaigns is now launching throughout the state to build on the success of the initiative in helping additional neighborhoods to go solar. To find New York Solarize campaigns, visit <http://bit.ly/NYSolarizeCampaignMap>.

Table info

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NY Sets Energy-Efficiency Targets to Address Climate Change

On April 20, 2018, New York Governor Andrew M. Cuomo announced an ambitious acceleration of energy efficiency in New York, including a comprehensive plan to achieve a new target for significant greenhouse gas emission reductions, decrease consumer energy costs and create job opportunities. Meeting the new energy efficiency target will deliver nearly one third of the greenhouse gas emissions reductions needed to meet New York's climate goal of 40% reduction by 2030. This announcement is part of the Governor's State of the State proposal to be developed from a milestone Earth Day energy efficiency target and comprehensive strategy.

"Energy efficiency is the most cost-effective way for New Yorkers to lower utility bills, curb harmful emissions and battle climate change," Governor Cuomo said. "As the federal government abdicates its responsibility to safeguard our environment, we must continue our bold action to reduce emissions and protect all New Yorkers, today and in the future, from the devastating effects of climate change."

"We're aggressively working to make New York more energy efficient with unprecedented goals to reduce greenhouse gas emissions and address climate change," Lieutenant Governor Kathy Hochul said. "The strategies to make our state cleaner and greener will result in high-tech jobs for New Yorkers with investments in workforce development. The focus on energy efficiency will not only enhance the environment and create new jobs, it will also lower energy costs for residents and boost the energy economy."



'Solar 100': New York City's Municipal Solar Strategy -- getting to 100 MW and beyond. Image: benkallos.com

Statewide, New Yorkers pay about \$35 billion annually for electricity and heating fuels, and buildings are responsible for 59% of statewide greenhouse gas emissions. The new 2025 energy efficiency target will cut emissions and energy costs by incentivizing building developers, commercial and institutional building owners, and residential households to pursue building improvements to reduce energy consumption by 185 trillion BTUs (British thermal units) below forecasted energy use in 2025, the equivalent to energy consumed by 1.8 million New York homes. Meeting the target will accelerate achievement of energy efficiency in the next seven years by more than 40 percent over the current path. The new energy

efficiency target will not only save substantial heating fuels but will set New York State on a path to achieve annual electric efficiency savings of 3% of investor-owned utility sales in 2025.

The initiative will support the growth of cost-effective private sector energy efficiency businesses and further Reforming the Energy Vision opportunities for third-parties to partner directly with utilities. These strategies will deliver benefits to New York consumers through new building retrofits, efficient appliances, and innovative technologies like heat pumps. New York's investor-owned utilities will also be called on to achieve significantly more in both scale and innovation through their energy efficiency activities. By accelerating innovation to deliver energy efficiency solutions, New York will cut emissions by cost-effectively reducing electricity and building fuel demand across the state. This initiative will support the Clean Energy Standard mandate to generate 50% of the state's electricity through renewable energy sources by 2030 and build on New York's national leadership on clean energy and climate change.

Energy efficiency is a significant part of New York State's clean energy economy, with more than 110,000 New Yorkers employed in energy efficiency-related jobs. The New York State Energy Research and Development Authority will commit an additional \$36.5 million to train over 19,500 New Yorkers for clean energy jobs to support this rapidly growing industry.

As part of this new energy efficiency target and recognizing the critical importance to include the state's most vulner-

able residents, Governor Cuomo is also directing the Public Service Commission (PSC) to ensure that a substantial portion of the new energy efficiency activity be directly targeted to programs for low-to-moderate-income New Yorkers, which will complement the State's existing progressive energy options for these New Yorkers. To implement this vision, individuals and organizations representing low to moderate income and environmental justice communities will be engaged and consulted to design impactful solutions, including the Governor's Environmental Justice and Just Transition Work Group. The State will build on the initiatives underway in the Clean Energy Fund (CEF) by working with stakeholders and others to advance innovative net zero energy retrofit prototypes for affordable housing, facilitating the adoption of energy efficiency improvements under Medicaid as a component of healthy homes interventions, and advancing the market for zero energy modular homes.

The strategy for achieving the new energy efficiency target also requires that New York identify opportunities by which state facilities can lead by example. NYSERDA and the New York State Department of Public Service are proposing innovative strategies and tools to achieve the target, including energy benchmarking to measure progress, accelerated building codes with implementation support from the CEF, and investment in heat pumps to deliver low carbon solutions for heating and cooling. Advancing clean energy technologies that support beneficial electrification in heating, cooling, and hot water also helps improve the efficiency of the electric grid to the benefit of all customers. NYSERDA and the Department of Public Service (DPS) have engaged with over 60 public and private sector stakeholder organizations in developing a strategy for this innovative and ambitious initiative.

DPS and NYSERDA will be submitting a White Paper into the PSC energy efficiency proceeding to determine the mix of programs, policies and regulations that will be necessary to achieve the 2025 target while reducing consumer costs. The proceeding will assess the viability of various program and policy options to dramatically increase energy efficiency and advance an all-fuels approach to achieve energy savings that most benefit New Yorkers.

To learn more go to: <http://bit.ly/CombatClimate>. 

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Citizen Participation in 100% Renewable Energy Goals in Hanover, NH

Last year Hanover, NH adopted the goals of using 100% renewable electricity by 2030 and 100% renewable energy for heating and transportation by 2050. The town is actively taking steps to reach these goals. An organized group in Hanover, the Neighborhood Action Group (NAG), is working to encourage neighborhood residents to have fun and get to know one another as well as to talk about how citizens and neighborhoods can work toward the town's renewable energy goals.



Many neighborhoods already have informal networks via email or other social media, and the Neighborhood Action Group wants to encourage neighbors to use the existing networks to share energy information. Each neighborhood has different needs and interests, and there is much expertise in each neighborhood as well as people making huge strides in moving toward renewable energy. For example, in one neighborhood, a net-zero house is being built, and the owner is willing to share information about this new house with other neighbors. In another neighborhood, neighbors have been bringing their leaf waste to a common area for years and now have a rich source of compost for their plants. The NAG believes that there is much already being done, and that we can use this and learn from one another how to help meet our town's energy goals.

A couple of neighborhood groups have already met. In one group two ideas came up which could benefit many neighbors. One neighbor expressed frustration about all the trees near her house which keep her from being able to have solar panels on her roof. Her suggestion was to get together as a group and see if a tree company would reduce prices for individual households for taking down some of the bigger trees if they contracted as a group. We are now pursuing this idea. Another idea was to develop some way to have yard waste collected. There may be ideas which are being tried such as the neigh-

borhood with the leaf waste common area that we can learn about and use as a group.

Neighborhood groups can also be used to gather information from citizens that might be useful to the Town of Hanover as well as to get information to citizens in the town.

NAG is now organizing a **Green Lawnmower Brigade for the Town of Hanover Fourth of July parade** (see article on page 3 of this issue). There are alternatives to gas lawn equipment which are quieter, generate zero emissions and save money. One EPA study shows that for every horsepower of its rating, a typical lawn mower emits air pollution equivalent to that of 3.67 automobiles driving at 55 MPH. The replacement of a single 24 hp diesel or gas mower with a 24 hp electric mower is the equivalent of removing 88 such cars.

We are inviting neighbors to bring people-powered mowers, their electric lawn mowers and other electric lawn



A high-performance home on Rayton Road in Hanover is an example of sustainability with solar PV and a sonnen battery backup system in addition to no use of fossil fuels. Learn more about this home in a future issue of Green Energy Times.

equipment, and march with us in the Fourth of July parade.

We also want our neighbors to know that there are other strategies to promote efficient lawn care as well. To reduce the amount of mowing you actually do, you can

reduce the size of your lawn by planting pollinator gardens and edible landscapes. To improve the efficiency of your current mower or leaf blower, make sure you have it serviced every year. If you are ready to upgrade your equipment, consider going electric.

It has been exciting to find out what other people are doing to reduce their carbon footprints. It is not a matter of pressuring one another to make changes. Rather it is knowing what changes one can make, knowing that every step helps and celebrating all that we can do together. It is empowering and synergistic!

To learn more, contact Barbara Callaway at bcallaway65@gmail.com. ♻️

The Toxic Dangers of Particle Board

Roddy Scheer and Doug Moss, EarthTalk®

Sadly, much of the furniture we enjoy every day is "off-gassing" toxins into the air, especially if it's made out of particle board, which traditionally relies on formaldehyde—a colorless, flammable, strong-smelling chemical and known respiratory irritant and carcinogen—to bond the wood chips and other filler together. If you've had the furniture for many years, the good news is that most or all of the formaldehyde fumes have long ago off-gassed out.



Uniboard is one of the leading particle board alternatives out there that don't use toxic formaldehyde to bind its filler material together.

and Disease Registry (ATSDR) adds that "chronic exposure to formaldehyde may also cause general damage to the central nervous system, such as increased prevalence of headache, depression, mood changes, insomnia, irritabil-

ity, attention deficit, and impairment of dexterity, memory and equilibrium."

Furthermore, the American Cancer Society reports that exposure to formaldehyde—classified by the federal government as a "known human carcinogen" since

2011—has caused cancer in laboratory test animals, and that people exposed to relatively high amounts of formaldehyde in medical and occupational settings are at greater risk for cancers of the nose and throat, among others.

"Scientific research has not yet shown that a certain level of formaldehyde exposure causes cancer," reports CDC. "However, the higher the level and the longer the exposure, the greater the chance of getting cancer." CDC researchers also worry that exposure to formaldehyde "might increase the chance of getting cancer even at levels too low to cause symptoms."

One precaution is to apply sealant designed to lock in potentially harmful

fumes (AFM Safecoat's Safe Seal is one). Or to just make the problem go away, maybe it's time for new, greener furniture anyway. Avoid the formaldehyde trap and look for products made out of solid wood, no resin required.

Keep an eye out for products made with sustainable alternatives to particle board, like Uniboard's woodchip-based NU Green Zero, Environ's newsprint and soy waste Biocomposite, and Pfleiderer's renewable wheat straw PrimeBoard. These greener choices are bound with a

polyurethane base free of formaldehyde and are popping up increasingly in the Targets and Walmarts of the world for those willing to read labels and ask questions in the quest to find the greenest versions of what's available.

Contacts: Safe Seal, goo.gl/2oWodG; CDC's "What You Should Know About Formaldehyde," www.cdc.gov/formaldehyde.pdf; Uniboard, www.uniboard.com; PrimeBoard, www.pfleiderer.com/row/PrimeBoard/PrimeBoard.

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A Letter to My Great-Grandchildren*Cont'd from p. 2*

grew up with, so that's what was normal for us. You probably see us as we saw the people who cooked over open fires in caves and grass huts, and who set fire to forests and grasslands so they could plant. Oh, well.

But I suppose the main point here is: why did we keep doing all this polluting, even after having been warned about its outcomes for more than the past 100 years, and in spite of having clean, cheap, healthy, alternatives available to us? All I can say is, it's hard to change one's ways, and the threats always seemed sort of far off. Yes, I know that people - especially children - are suffering increased rates of asthma; there are lots of earlier cancers; millions more people die every year; the climate is changing so fast that our deadly weather events are coming at us faster and stronger; crops are already suffering from the changes in water availability and pest migration; our antiquated infrastructure is crumbling under the strains; etc.

I think the big companies are waiting for us private folks to show we're willing to step up, and we're waiting for them. Our government sees us waiting for someone to make it free - or even profitable - for us to stop burning stuff, but the corporate interests are protecting their investors (our retirement accounts) by resisting government intervention - and they don't want to change unless they have to, either. And, yes, there are lots of incentives that make moving to sustainables cheaper than burning; but still, it does take effort. Most of us are just focusing on the day-to-day out-of-pocket financial costs of making the switch, not the much higher longer-term costs. It's really like a giant game of "chicken" (look it up), but with you in the middle.

We've been lured out of keeping savings accounts decades ago; we've learned to borrow money whenever we need it (do you know about credit cards? - ask) and then we basically work for the banks to pay it back along with a LOT of extra charges. We won't stop smoking or drinking or eating too much fat, etc. until the health effects actually hit us. Thinking into the future for our own best interests has atrophied to a vestigial state. So we've mortgaged our future for our present comfort. (Yes, I know that we, too, would be more comfortable moving on from fossil fuels; I'm referring to the comfort of not having to



Coal fired plants like the one pictured above and ocean freighters that carried so many things we thought we needed from other countries, released incredible amounts of CO₂ into our atmosphere. Images: public domain.

change.)

Thinking about you was similarly dismissed. Many folks said, "The kids will figure it out." Or, "Science will solve this problem," which belies one of our main excuses for doing nothing: calling climate scientists liars. Yes, we depended upon science for our food (including more meat than was good for us or our planet); transportation (banks always happy to get us into the latest gasmobile); medical needs (pills are easy to take). For example, hitting a button from inside my house or workplace to fire up my belch-mobile to warm or cool it saves me a few minutes of discomfort. But when those scientists have bad news for us that would require more effort than we want to expend, we call them liars.

So, we could have solved this problem completely anytime from the 1960s on, when it became apparent and would have been easy to address. (We went to the

moon instead.) During the early aughts we could have redirected the extra money our polluting was costing us in health care, storm insurance, repair, spill cleanups, and our half-hearted attempts to make ridiculously archaic Oil Age technology "not quite so bad." Or, if regular folks like me simply dedicated 5% to 10% of their income toward moving into the new Sustainable Age. But we didn't.

You see, we didn't like the "look" of solar panels on our roofs or in our yards (TV satellite dishes are OK, though); we suspect that wind turbines make "too much noise" and they "spoil our views;" [insert coal-fired power

plant pic] we "prefer" to cook with gas; we don't want to "learn" how to deal with an electric car (although they're better than internal combustion engine cars in every way that matters to us); and our oil or gas furnaces are "working just fine." And we'd "rather" listen to news reports about our politics instead of scary climate news - the political issues of the day are abortion, guns, immigration, more jobs (coal jobs, not solar or wind jobs). Both major political parties avoided talking about climate change as much as they can, because folks don't care and it only scares them into thinking that maybe something uncomfortable might be imposed on them.

Yes, the polar ice caps were melting fast, releasing incredible amounts of methane and CO₂. However, that just happens to free up shipping lanes for the worst-polluting of all our transportation choices: cargo ships (50,000 on the seas at any one time), which burn the cheap-

est, highest sulfur oil [insert oil freighter pic] -- BUT which make the stuff we buy from China at discount stores even cheaper! We spend lots of our free time watching violent TV and movies, searching for fancy restaurants, cheap jet travel destinations, and the latest fad diets to extend our life spans, but no time at all researching the lasting effects of our lifestyle choices and what they will mean for our descendants.

Our atmosphere is very thin: a dime lying on a 12-inch globe of our Earth is five times thicker than our breathable atmosphere. I mentioned before that enormous numbers of people were already dying from our pollution and climate change effects. But we knew almost none of these people; and the few we did know have conveniently died from "acts of God" (a favorite euphemism these days for the effects of our neglect). Our current estimates in my time are that about 100 million people will die in the next 10 years because of climate change. By your time, it's likely that a billion to 3 billion people will have died from thirst, malnutrition, climate/resource wars, migration, disease, pestilence, etc. directly caused by climate change. Some people seem to think that the food resources we depended upon can evolve to tolerate the five degree F. change in a couple of decades or so - and somehow evolve to resist the new biological attacks they'll suffer from mobile pest and plant infestations that move with the climate.

So, I've shared with you what looking back 80 years or so looked like to us -- boy, those folks were old-fashioned, less healthy, and struggling; but they were improving rapidly in every aspect of their lives. And you can decide what it's like to look back about the same distance to how we are living and what we are doing now compared to what you're experiencing in your time.

I am truly sorry. But I did want to share with you our thinking back here in the past. I shudder to think that some of you, my own descendants, have passed on early because of the cataclysms we set in motion. We weren't uninformed; we just decided to "go with the flow." I pray that things aren't even worse for you than our researchers told us they would be. For what it's worth, I'm sorry.

Greg Whitchurch writes occasionally for Green Energy Times. 

**THE DISRUPTION HAS BEGUN***Cont'd from p. 1*

demand periods, if there is not enough power, the actual frequency of the AC power sometimes has to be changed to keep the grid going. This creates a market for what is termed frequency control ancillary services (FCAS). The FCAS market, which usually operates on the spot market, has the highest prices.

Baseload plants are very inflexible and can take many hours to change their output. So on a mild spring early Sunday morning, when nobody needs much power, the plant may be producing more than it can dispose of. In such a case, the spot market can go into negative pricing, and the power plant will have to pay somebody to take the power it produces.

Power producers have to be compet-

itive when they bid for long-term contracts, but that means they cannot make a huge amount of money on them. What some of them have done is to sell some percentage of their power at a low price under a long-term contract, guaranteeing a steady income, with the rest going to short term or spot markets, where they hope to make the money then need to make a profit.

You might ask what the differences in price are. In Australia, where HPR was built, there is a law capping the price of power on all markets at \$14,000/MWh. (Australian dollars are about \$0.75 U.S.) It is clear to see why some companies would risk having to pay 10¢/kWh to get rid of power from time to time, when they can get upwards of \$10/kWh once in a while.

During the first four months of operation, HPR took up 54% of the South Australian FCAS activity, driving prices on that market down 90%. The \$50 million that South Australia put into the battery saved the state \$35 million in four months.

While this speaks to a remarkable return on an investment, it tells another story with worldwide implications. It means that any organization that has been selling at extremely competitive prices on the wholesale power market, making up for lackluster performance on the short-term markets, will have to change strategies. Unless it invests in batteries, it will probably have to make more on wholesale baseload power, and that means raising prices.

The ratepayers, however, get a break. Even in the absence of renewable energy,

the average prices of power would decline. And this means a reduction in retail costs.

And finally, there is another clear implication. Solar power and wind power, whose prices are already competitive with the lowest priced power generated from fossil fuels, gain in the competition, because they will no longer have to struggle with an image focusing on their intermittent nature. We can see much more solar and wind generation in the future.

And this means our air will be cleaner, and we can all breathe easier.

You might also be interested in the article, "The End of Fossil Fuels is In Sight," on page 19. 

FIVE COLLEGES COOPERATE FOR SOLAR

Amherst, Hampshire, and Smith, Williams, in Massachusetts, and Bowdoin, Maine

George Harvey

Five New England colleges have joined forces in a solar power cooperative. Three of them, Amherst, Hampshire, and Smith, are in central Massachusetts. One, Williams, is in far western Massachusetts, and one, Bowdoin, is in Brunswick, Maine.

Together, they are buying power generated at a solar facility in Farmington, Maine. NextEra Energy Resources, one of the largest clean energy companies in the United States, is developing the system. The solar system is expected to be completed sometime in 2019. NextEra is not only building the array, but is taking care of funding and permitting.

The plant is expected to generate about 46,000 megawatt-hours of electric energy each year. This is the equivalent of the annualized energy needs of about 5,000 average New England homes. It will provide substantial portions of the energy needs of all five of the colleges, though the actual percentage varies among them. It will also save each college money.

All five of the colleges were already working on efficiency and renewable energy to reduce their carbon emissions



Hampshire College Solar Array. Photo: Hampshire.edu.



Hampshire College, MA

and costs. One of them, however, will be especially recognized by regular readers of Green Energy Times, because of a series of articles in which it was featured.

Stories about efficiency or renewable energy at Hampshire College have appeared at least four times in GET in the past three years. Two of the articles were about buildings at Hampshire College that were examples of energy efficiency. The first of these was "Coming Soon to a College Near You," in August of 2015, which was about the Hitchcock Center. The second was "This is How You Do It," which appeared in October of 2015 and displayed the Kern Center.

In August of 2016, "Huge Solar ... Just in Time for Schools" told the story of a 4.7-megawatt solar array Hampshire College had under construction on land it owned. The most recent of these articles, "Hampshire College Is Powered by Sun-

shine," appeared in February, 2018, saying that the campus buildings were entirely solar-powered.

Anyone reading the last of these articles might be curious why Hampshire College would buy power from a photovoltaic (PV) farm in Maine. One reason was that it still had fifteen off-campus buildings that were not solar powered and it has a goal of to make itself "climate-neutral" by 2020. The college now gets 100% of its electricity from solar PVs. Another part of the reason is that Hampshire College wanted to help the other schools achieve their own renewable energy goals.

Smith College has a goal of net-zero greenhouse gas emissions by 2030. Any emissions it cannot eliminate by that time will be offset by such actions as planting trees. The cooperative will supply about 30% of its electricity and reduce its campus greenhouse gas emissions by 10%.

Also, Amherst College is developing its own climate action plan. Its participa-



Amherst College, MA



Smith College, MA



Williams College, MA



Bowdoin College, ME

tion in the cooperative is expected to supply about 50% of its electricity and reduce its emissions by about 17.5%. ♻️



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RESOURCES

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

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

American Council for an Energy-Efficient Economy: Consumer guide to home energy savings - aceee.org/consumer

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

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

Buildings Energy Data Book: buildingsdatabook.eren.doe.gov

Carbon Tax: carbontax.org

Clean Power Estimator: www.consumerenergycenter.org/renewables/estimator

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

Efficiency VT: This is a must-go-to site for immeasurable amounts of info. www.encyvt.com

Energy Efficiency & R/E Clearinghouse (EREC): eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html

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

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

Energy Star Federal Tax Credits: www.energystar.gov/tax_credits.

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

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Find Solar: www.findsolar.com

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

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

Greywater Info: www.oasisdesign.net/greywater

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

Home Power Magazine: www.homepower.com

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

National Solar Institute: www.nationalsolarinstitute.com

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

New Hampshire Sustainable Energy Assoc. NHSEA Focused on N.E. US, for consumers & industry- RE & clean building info, events. www.nhsea.org

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

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

NH Office of Energy and Planning: www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.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 Living Source Book: realgoods.com/solar-living-sourcebook

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 Energy Grid: www.pvwatts.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

Track the Stimulus Money: www.recovery.gov/Pages/home.aspx

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.

Vermont Tar Sands Action: Group working to stop the XL Pipeline and any other developments stemming from the Alberta Tar Sands. To join this group go to: groups.google.com/group/vt-tar-sands-action

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

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

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

www.susdesign.com Online info for solar benefit with house design: overhangs, sun angle & path...



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Help rebuild an educational farm in Puerto Rico post-hurricane Maria!

Camp Tabonuco is an environmental education program for youth in the mountains of Jayuya, Puerto Rico that fosters social and ecological stewardship through transformative learning experiences.

After the devastation left by Hurricane Maria, our lives and projects came to a halt. Sharing our mission of sustainable living practices with the future generations is now more important than ever.

Please help us rebuild our activity center and farm facilities where we host sustainable farming, arts and natural building workshops for youth. ¡Gracias! Learn more at bit.ly/Rebuild-Tobonuco.

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Larry Plesent

Ingredient of the Month

THE NORTH HOLLOW DIET, PART II A DIET FOR AN INCREASINGLY TOXIC PLANET

Today's Menu: Eating the Colors of the Planet

In the April 2018 issue of Green Energy Times, we talked about the North Hollow Diet. The discussion focused on how super nutrition combined with a reduction in exposure to dangerous chemicals is the only real answer to the daily war going on between our very much organic bodies and the unintended consequences of our modern convenience lifestyle.

We spoke about paying attention to engine exhaust and not standing in it or letting children play around it. We also talked about reducing food and liquid that is sold in clear plastic packaging, and how HDPE #2 plastic is the safest plastic commonly used by people.

We discussed the importance of eliminating plastic-packaged sodas and drinks, and how, if you only change one thing in

your life, this is the biggie to change.

In this month's article, we will explore the world of colors and nutrition. That is not a typo. Think about a bright red, juicy, fully ripe garden tomato. Yum! Now think about a pink, unripe and nearly tasteless mid-winter food service tomato. Yuck!



recipeler.com

Brightly colored fresh vegetables, fruits, meats and seafood are intuitively attractive to us. That's why

companies spend billions to dye your food, to make it look fresher and more nutritious than it really is!

Over 5000 plants synthesize bioflavonoids aka flavonoids. These substances are responsible for the palette of colors and many of the tastes found in nature.

One would imagine that our vast international society with its millions of scientists would know all about flavonoids, and their myriad effects on mammal health. But alas, this is not to be the case. And so I am not going to make any health claims about them. We can only hope that profit-based science will take an interest in these little wonders soon!

Combined with another class of plant molecules called polyphenols (that they are often found with or near), flavonoids are known to be anti-oxidant to humans. This means that they scavenge the byproducts of normal cell metabolism — all of which might possibly help keep you feeling clear headed and less run down, for example.

Some believe that a diet high in flavonoids and polyphenols helps keep the ends of their DNA from degrading. If this turns out to be true, then newly made cells from less than newly made people would have fewer mistakes. Fewer mistakes means the possibility of a longer, healthier life.

Others tout flavonoids and polyphenols as being cancer protective. While this may well be true, there is not enough hard evidence (read double-blind replicable studies) to state this as fact.

I promised to give you one thing to stop using with every article on this theme. However, having already asked you to give up plastic water, sweetened drinks, plastic processed foods and also to stay out of the way (at very least) of engine exhaust — I think you dear reader

already have your work cut out for you!

And so instead, here is a recommendation to live your time here as a lifelong learning proposition: learn to cook or improve your current skill set! Even master chefs and bakers take courses. Choose the types of food that feel right to you. The ones you dream about, think about or crave - as long as they are natural! The

better you cook, the better you live.

It is dangerous and misleading to make broad health claims based on food. I am not going to tell you that eating a diet rich in colorful herbs and vegetable plants

and fungi and therefore rich in vitamins, minerals, flavonoids and polyphenols will help you live a moment longer than you would on a diet of ultra-processed, wrapped and frozen, microwave-ready food products in single-use, heat tolerant plastic packaging would.

But I am saying that if you do switch to a diet closer to nature, you will enjoy a feast of color and flavor that might just extend your healthy time here. And if it turns out not to be so, you will have lived that much better for it. This is the secret of natural medicine. Above all else, do no harm!"

This is the Soapman asking everyone to visualize a more natural sustainable and colorful future.

Larry Plesent is a writer, philosopher and soap maker living and working in the Green Mountains of Vermont. Learn more at www.vermontsoap.com www.reactivebody.org and www.cancereraser.org ♻️

Brightly colored fresh vegetables, fruits, meats and seafood are intuitively attractive to us.

A Pledge to Live More Sustainably Church Members Commit to Reducing Their Personal Carbon Footprint

George Plumb

Carbon emissions keep on rising! What we need now is for humanity to change their lifestyles, so that we live more sustainably and less consumptively.

The Unitarian Church of Montpelier is the first church in Vermont to offer its members and friends an opportunity to sign a pledge with major items to reduce their carbon emissions. Approximately thirty people signed the pledge and, as a result, a group is forming to discuss how people are living up to the pledge and further actions that people can take to address climate change.

The pledge states:

Out of "Respect for the Interdependent Web of Existence of Which We Are a Part," (Unitarian Universalist Seventh Principle), other spiritual groundings, and a deep concern for all life on Earth; I pledge to do all I can to reduce my contribution to global warming and the Sixth Great Extinction

I PLEDGE to do the best I can to live a sustainable and simple lifestyle, to the extent possible, given my financial situation and family support. This includes:

- Limit the use of petroleum-fueled vehicles and equipment,
- Drive the most fuel-efficient personal vehicle possible with thoughtful consideration of a hybrid or solar powered car,
- Use renewable energy to heat and light housing,
- Insulate housing to the best extent possible,



George Plumb is pictured on the left along with Dan Jones, while one of the church members signs the pledge.

- Minimize the size of lawns and the use of lawn chemicals,
- Maximize use of local food and minimize eating of meat,
- Minimize purchases in general and non-durable goods in particular,
- Minimize waste by rethinking, reducing, reusing, and composting as much as possible,

- Minimize recreational travel, particularly flying on a jet plane or taking a cruise only once every few years if at all or buy carbon credits to offset the effects, and
- Promote population reduction by replacing myself only once or not at all (if applicable) and supporting my children, grandchildren, and all relatives and friends if they decide to have one or no children.

There are two excellent books about our personal greenhouse gas emissions. One is How Bad Are Bananas?—The Carbon Footprint of Everything written by Mike Berner-Lee in 2010 and published by Greystone Books. The other is The Burning Question—We Can't Burn Half the World's Oil, Coal, and Gas. So how do we Quit? It was written by Mike Berner-Lee and Duncan Clark with a foreword by Bill McKibben. It was published in 2013 by Greystone Books.

Of course there are numerous web sites that also detail our carbon-emissions sources.

The pledge was developed by eighty-one year old George Plumb who has witnessed much environmental destruction over the course of his life, been a long-time environmental activist, and has lived up to most of the pledge including having traveled in a jet plane only once in his life for recreational purposes. He has voluntarily delivered the Green Energy Times in Central Vermont for several years in his Nissan Leaf. Dan Jones (see photo) heads up the Net Zero Montpelier organization, Vicky Viens, another member of the church, also helped to develop the pledge.

Other churches and spiritual organizations are encouraged to offer their members and friends a similar opportunity to sign a pledge.

For more information, contact George Plumb at 802.883.2313. His email is: plumb.george@gmail.com.

ELMORE ROOTS' PERMACULTURE KNOW-HOW

Plant Once, Harvest Forever

David Fried

Painting by Gabriel Tempesta



Does this seem too good to be true? It is too good, but it is also true.

One of the magical things about planting a fruit tree is that you dig a hole and plant it, and if it likes its spot, it can be there for a long time. An apple tree can live for over a hundred years, and a pear tree almost two hundred. Birds, cows and people spread their fruit around and seedlings come up in the hedgerows, and so the tree you planted can have grandchildren that can grow and keep fruit in the neighborhood forever.

This spring, we are already eating sorrel leaves from our perennial vegetable garden, along with asparagus, horseradish roots and leaves in sandwiches, and Jerusalem artichokes. We planted them about 10 years ago, each in their own row. We mulch with straw or grass clippings in the spring, and they feed us every year.

We do not need to plant or till, or weed, or rarely feed. They feed us! This is the kind of garden I want to live near. It is self-sustaining and zero to low maintenance. Good for you, and good for the land.

Growing fruits and nuts is simply a good idea. A tree may seem to cost a lot, but when you realize this tree may be producing for the next 30 years, it costs less than a pack of seeds per year!

How do they do it? A vegetable has to get things ready fast, for it will not be here when it gets colder. The nut tree puts its energy into building its roots and slowly sends up branches when the roots can support these. Once it starts producing nuts, it makes a lot of them- all the squirrels and blue jays and nut butter loving people will

be hanging around your place a bit more.

How does a tree produce so much fruit each year after only being planted once? We don't really know. Some say it has an angel nearby whispering "grow, grow." We have a feeling that the tree's roots can mine all the nutrients it needs from the earth, and then give back to the earth its leaves and fruits, so nothing is wasted. The citizen's party candidate for governor in Vermont, John Potthast, summed it up in his campaign slogan in 1980, "Ecology is nature's balanced budget!"

Here at Elmore roots, for the last 40 years or so, we have realized that planting vegetables is fun and good and exciting. But planting nut trees and berries and fruit trees is a good way to get a lot of healthy and tasty crops without disturbing the earth. In fact, they make the land better. Whole mini ecosystems thrive under and around each tree.

This is how you can plant once and harvest forever..

David Fried is the grower, harvester, and writer who started Elmore roots nearly 40 years ago. ♻️

Exotics can be Pest-Free

George Harvey

Some plants are just naturally ready for changing climate, and many of these can be grown in colder areas if they are kept in pots and brought indoors or into a greenhouse for the winter. Some have the added advantage that they find few pests in our area.

A friend and I share plants that we put in a sunny area for the summer. We keep them in a greenhouse in cooler weather of fall or spring and bring them inside during the winter.

Our calamondin is especially delightful. Only four feet tall, it bore over a hundred fruit last year, each a little smaller than a ping-pong ball. Calamondin fruit are very tart. Some people eat them like kumquats, and they make amazing marmalade. Other citrus we have had success with include Meyer lemon and lime. We are sprouting finger limes this year from seed.

A fig tree can be quite productive, if you keep it in a sunny place during frost-free months. Figs are also very pleasant companions in a living room window. We are also just now sprouting olives to grow in pots. We will let you know how that works.

Many of these can be bought as plants at local nurseries.

Emerald Ash Borers

Cont'd from p.21

people in areas infected by the insect should respond to inevitable tree loss.

In Vermont, state officials are developing a plan to discern the extent of the infestation. Road-side ash inventories will likely be components of this effort so that vulnerable areas can be managed to prevent damage by falling trees. In the meantime, Rosovsky quoted her colleague Barbara Schultz, the forest health program manager at Vermont Forests, Parks and Recreation: "don't panic and don't cut all of your ash trees." Despite the grim prospects, not all the trees will die immediately. According to Rosovsky, "if you are further than five to ten miles from the infestation, you are not at immediate risk."

Unfortunately, towns and property owners should plan for reduced dependence on ash in their landscapes. For example, at Saint Michael's College where I work, we are considering our options.

About 85 ash trees grace our campus with many more scattered through the natural area. According to Alan Dickinson, Associate Director of Grounds, EAB can be checked by injecting insecticides into the soil every other year, but this is an expensive option that at most, can protect individual trees.

Preventing the movement of infested wood is the highest priority for slowing the spread of this and other forest pests. Left to their own devices, EAB infestations in Maryland spread at a rate of only a half mile per year. However, as noted in the Vermont Department of Forests, Parks, and Recreation literature, "...all stages of the insect can travel 65 mph down the interstate inside infested wood!"

All bordering states and Quebec have emerald ash borer infestations. With beetles also found in Orange, Washington, and Caledonia Counties, no Vermonter lives more than 70 miles from an infestation. I won't be felling the green ash from the corner of my yard any time soon, but sadly, neither will I plan on planting any new trees.

Declan McCabe teaches biology at Saint Michael's College. His work with student researchers on insect communities in the Champlain Basin is funded by Vermont EPSCoR's Grant NSF EPS Award #1556770 from the National Science Foundation. The illustration for this column was drawn by Adelaide Tyrol. The Outside Story is assigned and edited by Northern Woodlands magazine, www.northernwoodlands.org, and sponsored by the Wellborn Ecology Fund of New Hampshire Charitable Foundation: wellborn@nhcf.org.

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Will Agriculture Save the Bees?

U.S. farmers will soon plant up to 180 million acres of corn and soybeans coated in neonicotinoid pesticides, a combined landmass nearly twice the size of California.^{1, 2}

But neonics harm the bees that make much of our fresh food production possible and offer no significant benefits in terms of crop yields.^{3, 4}

Since the late 1980s, neonics have become the most widely used class of insecticides in the world.⁵ And experts believe pesticides like neonics are one factor in the alarming decline of bee populations in recent years – **the USDA reports that U.S. beekeepers lost 44% of their colonies between 2015 and 2016.**⁶



Losses of this size are unsustainable and could have disastrous effects on our food supply, our

environment and our economy. **In the U.S. alone, honey bees pollinate an estimated \$15 billion worth of crops every year – from strawberries to broccoli to the alfalfa used to feed dairy cows.**⁷ The bottom line: without bees, we don't have food.

What can you do? There is already momentum to address this urgent and worldwide threat. Maryland and Connecticut have both taken important action to limit the use of neonics, and across the pond, the European Union may soon vote to completely ban neonics.⁸

So we're calling on states to protect our best pollinators. Call your state representatives today! Let your voice be heard before more damage is done this year.

Links available on the Green Energy Times website. ♻️

Report Signs of the EAB

Vermonters outside the EAB-infested area (Plainfield, Groton, Calais, Williamstown, Washington, and Barre) and throughout the state should always ask their firewood dealer where the wood is coming from. The rule of thumb is to not move any untreated firewood more than 50 miles, and Vermonters living outside the infested area can do their part to slow the spread of EAB by making sure they are not purchasing infested ash.

EAB overwinter as larvae under the bark of ash trees where they feed on the inner bark tissue. Once infested, ash trees rapidly decline and are killed in 3-5 years. This pest is known to be established in 32 states and three Canadian provinces, and is responsible for widespread decline and mortality of hundreds of millions of ash trees in North America.

Vermonters are encouraged to look for signs and symptoms of the emerald ash borer and report suspicious findings on VTinvasives.org. Detailed information about the pest and what to look for may be found at the same website. Vermonters can also learn more about what EAB damage looks like and how to report a potential sighting by visiting http://agriculture.vermont.gov/Emerald_Ash_Borer. Video and pictures of EAB damage in Vermont can also be found there. Private land owners looking for information about managing ash in woodlots and UVA (current use) plans should contact their county forester, contacts for which can be found at <http://fpr.vermont.gov>.

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Celebrating the Contributions of Cooperative Enterprises

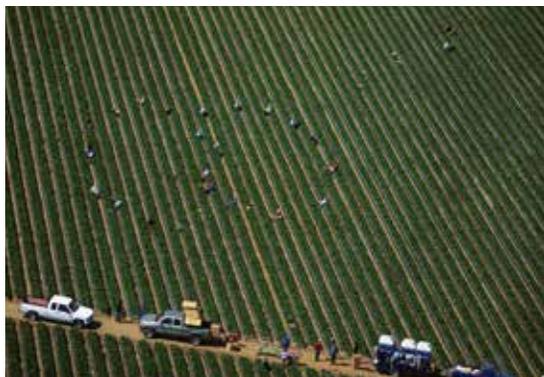
Fran McCrae

On July 7, 2018, the world will celebrate the International Day of Cooperatives (IDC), an annual observance of the contributions of cooperative enterprises to sustainable development.

To appreciate the significance of the IDC, it is important to understand what sets cooperatives apart from other enterprises. A cooperative is a people-centered business model, in which the members, be they workers, producers or customers, are the owners of the enterprise. Members, rather than shareholders, participate democratically in the cooperative's governance to make decisions about how to manage the business. The purpose of the co-operative is to serve members' economic and social needs.

Cooperatives are based on a set of values, which include self-help, democracy, equality, solidarity and openness, among others. To put these values into practice, all co-operatives subscribe to seven principles, among which are voluntary and open membership, member economic participation and autonomy and independence.

Driven by people's needs rather than just the bottom line, cooperatives have shown their ability to help people pull themselves out of poverty, improve access to basic goods and services, provide



Cooperatives have two centuries' experience building sustainable and resilient societies. Credit: International Co-operative Alliance.

decent and stable work and invest in environmental sustainability and community development.

The cooperative movement represents an important economic and social force. According to the 2017 World Cooperative Monitor, the largest 300 cooperatives and "mutual" in the world generate a combined annual turnover of almost \$2.2 trillion, more than the GDP of Brazil.

Despite their impact, cooperatives are still one of the best-kept secrets in the development toolbox. By highlighting a different aspect of the cooperative identity every year, the IDC works to change that.

Celebrated on the first Saturday of July, the IDC has been observed by the cooperative movement since 1923 and became,

in 1992, an official International Day of the United Nations through a resolution passed in the General Assembly.

In 2018, the International Day of Cooperatives will focus on the theme of sustainable consumption and production with the slogan "Sustainable societies through cooperation."

Cooperatives have sustainability in their DNA, with 'concern for community' as the seventh of their guiding principles. The International Day will showcase how cooperatives run successful businesses while respecting our natural environment and building sustainable and resilient societies.

This theme echoes the twelfth Sustainable Development Goal (SDG) on responsible consumption and production. The seventeen SDGs were adopted by the UN Member States in 2015, in an ambitious global initiative to build a better world by 2030.

To learn more about cooperatives or get involved in the IDC, please visit www.copac.coop.

Fran McCrae is Coordinator of the Committee for the Promotion and Advancement of Cooperatives (COPAC). COPAC is a global partnership made up of the United Nations Department for Economic and Social Affairs, the International



Labour Organization, the Food and Agriculture Organization of the United Nations, the International Co-operative Alliance and the World Farmers' Organization, with the goal of championing cooperative enterprises as leaders in sustainable development. ♻️

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FIRE OR FUNGI?

Jessie Haas



Flickr/Ryan Thompson

University (MSU) and the Union of Concerned Scientists showed that cattle finished on grass in the Midwest sequester enough carbon to completely offset their methane emission. Their lead researcher says, "This research suggests that ... adaptive multi-paddock grazing can contribute to climate change mitigation through soil organic carbon sequestration and challenges existing conclusions that only

feed-lot intensification reduced the overall beef greenhouse gas footprint . . ."

Who's right? The MSU study is narrower and deeper. It takes into account all associated emissions from feedlot and pasture finishing. It also avoids a major mistake made by FCRN. Their study assumes large inputs of fertilizer, and mechanized management, causing CO2 emissions. But that's not how grass-fed works. At worst, cows are turned loose on pasture to fend for themselves. At best, they move from one small paddock to the next, grazing, fertilizing the ground with their manure, and requiring only that someone walk out and open the next gate. The MSU/UCS study takes that reality into account. That and its focus on a modern, advanced grazing system probably accounts for the difference. Carolyn Grindrod of Wilderculture notes that "Well-managed pasture is a HUGE photosynthetic cell that cools the planet, filters pollution, prevents heat hazes, keeps the water in the ground and rivers, and as a by-product produces a nutrient-dense food source that humans are well-adapted to eat."

Grazing can't be properly understood as

a simple carbon-to-methane ratio. They are part of a complex biological system that we humans have unbalanced. According to Walter Jehne, "Nature created our soils, bio-systems, their hydrology and climate via carbon drawdown rates that exceeded oxidation rates, yet for 10,000 years we have reversed this. While plant photosynthesis is critical to fix solar energy into plant bio-mass, it is what happens next to that biomass that matters. Does it rapidly oxidize back to CO2 by burning or does it get partly bio-converted by fungi into stable soil carbon? There are no other options. We live in the balance between fire and fungi."

Cattle on pasture tip the balance toward fungi, and scientists are finding ways to make them even more effective. A California study finds that spreading compost on rangeland resulted in far greater carbon sequestration. Meanwhile feeding seaweed, tannin-rich leafy fodder, and common mineralized salt blocks can reduce enteric methane significantly.

Managed grazing is recognized as a climate solution by the IPCC and Project Drawdown, among many others. Buying grass-fed beef is one way consumers can help soils tip the balance from fire to fungi.

Jessie Haas has written 40 books, mainly for children, and has lived in an off-grid cabin in Westminster West, VT since 1984, www.jessiehaas.com. Links available with the posting of this article on the GET website.

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Beat PLASTIC POLLUTION

George Harvey



Plastic washed up on a beach is just a portion of what is also in the oceans. Photo by Dustan Woodhouse, unsplash.com.

The United Nations (UN) has observed World Environment Day on June 5th every year since 1974. Each year, the UN chooses a theme for the event to focus the attention of people worldwide on some specific problem that needs to be addressed. This year, the UN's theme is "Beat Plastic Pollution."

The environmental problems posed by plastics have increased at an alarming rate in the last few years. News media have focused a large number of stories on them, both illustrating the problems and showcasing some

of the solutions. But people should not be surprised, considering the numbers. Estimates put the number of single-use plastic bags being handed out to customers worldwide at one million to two million, every minute. Plastic bottles are produced at the same rate. As a species, we use about 335 million metric tons of plastics every year.

The problem is widespread. Huge amounts of plastic, concentrated by the action of wind and waves, have concentrated in five remote ocean gyres. This was the subject of the article, "Garbage Patches in our Oceans," in the August, 2015 issue of Green Energy Times.

Plastics cover streams and rivers. They blow across the land. Plastics kill animals from micro-plankton that form the basis of nearly all animal life in the oceans to some of the largest animals on Earth. Recent news stories covered the autopsy of a pilot whale that died because it was unable to digest food after accumulating



Plastic pollution affects us all. This situation could suffocate and kill the dog. Photo: sayannalanda, Wikimedia Commons.

eighty plastic bags in its stomach. Plastics kill birds and land-dwelling animals.

A somewhat controversial report said that by 2050 there would be more plastics than fish in the ocean. Interestingly, when reporters checked the facts of the report, they only went so far as to say it might be wrong, and not so far as to say that it was certainly untrue.

One problem is that most plastics do not decompose easily, so the trash just keeps growing. Another is that burning many plastics produces toxic compounds, such as dioxin. But even those that can be recycled or reused are very often tossed away carelessly only to make things worse.

The UN reported that governments ranging from countries down to municipalities have started to take action. In the United States, several cities have taken measures to reduce the use of plastic bags. Countries from Chile to China have taken action on a wider basis. The United Kingdom has already reduced the use of single-use plastic bags by 80% through the simple act of taxing them at five pence each. Scores of other countries have also taken action.

An important problem the UN cited as an impediment to reducing our use of plastics is a lack of adequate enforcement. But we could be effective by finding alternatives to plastics, or by developing plastics that are biodegradable and prohibiting the plastics that cause problems. One thing that is clear is action is needed.

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Jonny Finity

Household hazardous waste (HHW) includes any product that is poisonous, reactive, corrosive, or flammable. This includes automotive fluids, fertilizers and pesticides, paints and stains, and many common household chemicals.

You can easily identify hazardous products by reading product labels. Look for key words such as Warning! Danger! Poison! and Caution! Improper disposal of hazardous materials is illegal—and it poses a risk to human health and the environment.

Good: Get rid of them properly

Keep all products in their original, labeled containers when possible, and pack upright in boxes. If a container is leaking, enclose it in another suitable container. Never mix chemicals.



The Chittenden Solid Waste District (CSWD) collects household hazardous waste at the Environmental Depot (1011 Airport Pkwy., South Burlington), and the Rover, CSWD's mobile collection unit for household hazardous waste. The Rover visits every town in Chittenden County once per year. Find the schedule online at www.cswd.net/rover. Chittenden County residents can use both facilities at no charge; fees may apply to businesses and out-of-district residents.



Better: Use up what you have

CSWD operates programs to help residents and businesses responsibly dispose of household hazardous waste to make sure the environmental damage is reduced or eliminated. CSWD looks for reuse or recycling opportunities wherever possible, such as their Local Color program to produce high quality recycled latex paint. But it costs about half a million dollars per year to operate the program, and many of the products collected are transported across the country where they will sit in a landfill specially designed for hazardous wastes.

CSWD recommends that you use up the hazardous wastes you have, so you don't need to dispose of them. Store them properly and use them according to the directions. If you no longer have a use for it, check with a neighbor or friend to see if someone else does.

Best: Reduce hazardous waste from the start

What's the best way to avoid dealing with hazardous materials? Buy less of them.

- Use non-toxic products where possible. Many types are widely available at grocery and hardware stores. The Environmental Working Group produces reputable info on products, including the Guide to Healthy Cleaning and Skin Deep Cosmetics Database (www.ewg.org).
- Buy only what you need. Carefully measure the space you're going to paint, stain, or clean to prevent over-buying.

- Make your own greener cleaners! Search the web for thousands of recipes..

Jonny Finity is the Marketing and Communications Manager for Chittenden Solid Waste District (CSWD).

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