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WHAT DO YOU DO FOR A LIVING?

(YouTube screen shot)

By George Harvey

One of the most interesting videos I have seen recently is "Climbing Wind Turbines for a Living | That's Amazing" (http://bit.ly/wind-technician-video), produced by the Weather Channel. In it, Jessica Kilroy, an attractive young woman who laughs as she refers to herself as a "blonde chick," talks about her job. The video is full of pictures of her doing her work, dangling from ropes at the tip of the blade of a wind turbine, with about 330 feet of nothing at all between her and the earth's safety.

Kilroy is clearly a person who enjoys and takes pride in what she is doing. It is challenging work physically. As a child, she had medical problems that prevented her from skipping rope or playing basketball. Her ability to take on a job that may start with climbing a 35-story ladder to the top of a wind turbine shows that the effort she put into overcoming those problems paid off.

She also takes a good deal of pride in working in an industry that is good for the environment. An avid rock climber, she is very aware of nature. The job she has, doing such things as repairing wind turbine blades that have been damaged by lightning, helps provide the solution to the environmental problems that we have. The most dangerous sources of energy we have, in terms of effects on wildlife, are fossil fuels; by comparison, wind turbines are altogether benign. Kilroy contributes to our reduction in the use of fossil fuels by keeping the wind turbines running.

There is one thing about the wind turbine technician's job the video does not mention. Wind turbine technician is the fastest-growing job in the United States, according to a report recently published by the Environmental Defense Fund (EDF), "Now Hiring: The Growth of America's Clean Energy & Sustainability Jobs" (http://bit.ly/sustainable-jobs-growth).

Other jobs in sustainability are also growing very fast. The EDF report says, "Solar and wind jobs have grown at rates of about 20% annually in recent years and are each creating jobs at a rate 12 times faster than that of the rest of the U.S. economy." While

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NASCAR VS. LEILANI MÜNTER

Leilani Münter, vegan, hippie chick with a racecar and a mission for the planet. Photo credit: Scott LePage.

By Sara Gutterman

If you've never heard of Leilani, the beautiful and talented environmentalist race car driver, you're missing out. Münter, the only carbon-neutral NASCAR driver, uses her sport in the most unlikely way to promote climate action. Her mission is to completely revolutionize the racing industry, and given her powers of persuasion, I have no doubt that she will win.

Leilani Münter likens herself to a bumble bee, which for all practical (and physics-based) purposes, should never be able to fly. Like the

Cont'd on p.7

This Is Not A Tragedy! – It's the First Act of a Comedy

Trump, the EPA, and the Clean Power Plan

By George Harvey

Donald Trump has acted to trash the Obama Administration's Clean Power Plan (CPP). For some of us who cherish Mother Earth and our own progeny, this was a truly frightening action. Some have gone so far to call it a "planetary death warrant." But please, do not despair. The issue is not over. More to the point, Donald Trump's actions may only serve to highlight his own futility, which is looking increasingly extreme.

To understand this, we might first look at why the Environmental Protection Agency (EPA) created the plan. It did not do this to kill coal or push renewable energy. In fact, it tried to avoid regulating carbon emissions altogether. It created the plan because it was ordered to regulate carbon dioxide emissions after the Supreme Court decided carbon dioxide is a pollutant, in the 2007 decision, Massachusetts v. Environmental Protection Agency. Neither doing away with the CPP nor defunding the EPA will get Trump off the hook on this.

With that bit of background, we can start to appreciate the comedy of the situation. Because of the court's decision, neither Scott Pruitt nor Donald Trump can simply do away with the CPP. If they are to do anything at all, it must be to replace it with something that will effectively regulate carbon emissions. And Pruitt's opinion that climate change is not driven by carbon dioxide is inconsequential. In taking over the EPA, he assumed responsibility for dealing with carbon emissions under a federal court order. Addressing this issue, Ben Longstreth, a senior attorney at the National

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Late Breaking News

Rick Perry-Lost in the Past

Bringing G.E.T. to NY! nyses.org

By George Harvey

Rick Perry has directed the Department of Energy (DOE) to do a 60-day study of the United States electric grid. The memo was not publicized or posted, but I got a copy from the DOE. When this article appears online, the memo will be attached.

At first glance, it looks innocuous. Nevertheless, it was based on bad assumptions and seeks answers that support the administration's political views. Perry started the memo by expressing a concern about what he called a "need for an energy transition utilizing greater efficiency and fuel diversity." That might sound innocuous, but it is not because it makes an assumption. It says right from the start that we need to use fuel.

Perry went on, saying, "Baseload power is necessary to a well-functioning electric grid. We are blessed as a nation to have an abundance of domestic energy resources, such as coal, natural gas, nuclear, and hydroelectric, all of which provide affordable baseload power and contribute to a stable, reliable, and resilient grid."

Neither wind power nor solar was mentioned as a resource. From Perry's memo, I can only assume that he believes they cannot contribute to baseload power, which they are doing in power grids in other parts of the world. Wind power, for example, is starting to be used to stabilize the grid in northern Germany and Denmark.

Perry said, "[Some people] have highlighted the diminishing diversity of our nation's electric generation mix, and what that could mean for baseload power and grid resilience. This has resulted in part from regulatory burdens introduced by previous administrations that were designed to decrease coal-fired power generation." Clearly, Perry's assumptions are based on Trump's propaganda.

Continuing, Perry said, "Finally, analysts have thoroughly documented the market-distorting effects of

Cont'd on p.19

Meet the Newest Member of the G.E.T. Family

From the Publisher: The G.E.T. team is happy to introduce Lindsay Miller as one of our newest advertising sales representatives. Lindsay comes to G.E.T. with a strong communications and sales background. Lindsay received her Bachelor's degree in communications with a focus on journalism from Castleton College. Lindsay resides in the Northeast Kingdom of Vermont (Caledonia and Essex Counties) and shares her opinion on windmills below.

Windmills are Beautiful

By Lindsay Miller

A lot has changed since I stated my opinion on the East Haven Wind Farm in 2003 (http://bit.ly/2osKpMK). According to VTdigger.org in 2012, 14 projects have been proposed that included 400 foot tall wind turbines that would generate electricity varying from 100 kilowatts to 100 megawatts; some have continued to be fully functioning wind farms and others ended up as someone's idea and a large controversy. East Haven eventually met defeat in 2006 because of the impact it would have on the bird and bat population. In 2009, the Vermont Public Power Supply Authority purchased a lease of the East Haven site to process a new proposal for a three tower farm. I wasn't able to find any other information about whether this has been done yet.

Lindsay Miller at the Sheffield wind farm in Sheffield, VT. Courtesy photo.

Successes in this controversy are Sheffield Wind, in Sheffield, VT. In 2011, Sheffield welcomed the largest operating wind farm in VT at the time, with sixteen 420 foot tall turbines, producing approximately 40 megawatts of electricity. Sheffield is most likely the most successful project with minimal adverse impact on the environment and neighbors. The Lowell Wind Farm, also called Kingdom Community Wind, opened in 2013 but not without a fight. Kingdom Community Wind consists of 21 turbines producing 63 megawatts of power. Proposals in Vermont that didn't make the cut or are still in the works include projects in Newark, Grandpa's Knob (West Rutland), Poultney, Ira, Manchester, Sunderland, Derby Line, Waitsfield and Londonderry. All the projects have run into resistance in one form or another.

I talked about the worry about the wind farm being an "eyesore" and how it would impact the Northeast Kingdom's tourism industry being completely false. Further research did not change my opinion. BiGGAR Economics analyzed the impact of Scottish windfarms on tourism related employment in the area, and they found no evidence to suggest wind farms had an adverse effect. They compared the level of wind farm installations and the level of employment in the tourism sector between 2009 and 2013 at both a national and local level. The national number of turbines increased 121% and tourism related employment rose by 10.8%. They did find that sometimes the distribution of wind farms and tourism jobs varied, so to alleviate this problem they focused on areas with a higher proportion of wind turbines. The results of this study mimicked the results of other studies done in the past, and some results hint that the wind turbine itself has become an attraction.

Another exciting project is Burke Mountain's installation of its very own wind turbine at the summit of the mountain to help provide skiers and riders that authentic Vermont experience and provide sustainability to Burke Mountain's long term picture. The turbine is only the fourth functioning wind turbine installed at a ski area in the United States.

In regard to the closed Vermont Yankee, operation ended in 2015 and is planned to be completely decommissioned by 2020. Since the closing, Vermont has relied on natural gas to fill in the gaps in energy demand. The Instituteofenergyresearch.org mentions in a study that in 2015 natural gas supplied 48.6% of New England's energy needs, when in 2014 it only supplied 43.1%. Coal decreased from 4.6% to 3.6% ,and wind and solar went from 2.1% to 2.4%.

Over the past 14 years my opinion has not changed. I cannot fathom why anyone could be against wind turbines or any other form of renewable energy. I don't feel that they take away from any of the aesthetic value of Vermont's ridgelines, and I feel that if we continue using fossil fuels we will damage more of Vermont's pristine environment than by adding wind farms. Tourism doesn't seem to be affected by the wind farms that have successfully opened. Vermont has survived without Vermont Yankee, even though I wish they had resorted to renewable energy instead of natural gas.

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Carbon Fee and Dividend for a Bright Green Future

By John Gage

The transition to clean energy is underway, but not fast enough to prevent life-changing consequences from greenhouse gas emissions. Carbon dioxide (CO2), the major contributor to climate change, sea level rise, and ocean acidification, comes from burning fossil fuels. According to leading scientists, a CO2 concentration above 350 parts per million is unsafe. We overshot that mark a few decades ago, and the concentration continues to rise. The Keeling Curve from the Scripps Institution of Oceanography at UC San Diego is sobering.

This CO2 trend is due to a failure in the energy market, where success is decided based on such factors as availability, convenience, and price. The cost to society from the use of fossil fuels is not reflected in their price, so the market equation is incomplete and fossil fuels seem to remain a compelling option.

Fixing this market problem will release tremendous demand for clean energy. When fossil fuels' true costs are reflected in their price, investors and consumers will naturally prefer alternatives. Such a shift should be done predictably and incrementally to give both time to react.

Many people assume that addressing the problem will be costly and require sacrifices. They worry that putting a price on carbon emissions will just lead to increased spending by the government. However, there is a simple solution: rather than having the government spend it, return all the money collected back to households.

900 Citizens Climate Lobby volunteers before visiting 502 Congressional offices on June 21, 2016. Photo: Citizens Climate Lobby.

The Carbon Fee and Dividend proposal from Citizens Climate Lobby does just that. It would charge an initial fee of $15 per ton of CO2 that a fossil fuel will emit, levied at the mine, well, or port of entry. The fee would be increased by $10 each year. With a steadily increasing cost for fossil fuels, businesses and investors will shift their focus from fossil fuels to clean energy. An independent study by Regional Economic Models, Inc. (REMI) found that by correcting the energy market in this way, fossil fuel emissions will be reduced to just 10% of 1990 levels in a few decades.

All the money collected from the fee (minus administration costs) would be returned as a dividend each month to all American households equally, one share per adult, and a half share per child up to two children per household. The REMI study found that nearly two thirds of households would at least break even under the proposal. Low-income households will be able to spend more, increasing the gross domestic product by $1.375 trillion and adding 2.8 million jobs, both within twenty years.

To address the problem at the global level, border adjustment tariffs would be applied on imports from countries that do not have comparable prices on their carbon emissions. This would normalize production costs among countries, protecting U.S. jobs and motivating our trading partners to follow our lead.

One reason we have not already done this is that powerful members of the fossil fuel industry have focused for decades on profits rather than heeding warnings of climate science. They have used their financial strength to delay action. They did this by funding public relations campaigns to confuse the public about the scientific consensus and supporting political allies. Our future depends on breaking their grip of control and shifting to clean energy.

We must build a consensus, enabling Congress to act, by promoting our common interests over those of the special interests. If we remain quiet, we implicitly support the status quo. By speaking out, each of us can be part of a fundamental and necessary change for human civilization. Citizens Climate Lobby does this in a way that is respectful and effective.

It is time for the U.S. to commit to addressing greenhouse gas emissions with a solution that attacks the root of the problem. This can be done by allowing price to reflect the true costs of each option. The Carbon fee and Dividend is a beneficial way for us to do that.

Climate change is a top concern. Please talk to your friends and family about the problem and the Carbon Fee and Dividend solution. Call or write your Congressmen and let them know climate change from fossil fuels is an important issue to you, and that you prefer the Carbon Fee and Dividend solution to address it (try this: http://bit.ly/CCL-write-congress). If you own a business, consider endorsing carbon pricing. By voicing our shared concern, we can get our common interests addressed.

For more information, visit CitizensClimateLobby.org.

John Gage is a volunteer for Citizens Climate Lobby and is the CCL NH South Central chapter leader, cclnhsouthcentral.org

Tax Reform and Climate Action:
STARTING THE CONVERSATION

By Dana Drugmand

On yet another record-breaking warm day in April, a group of Vermonters gathered on the lawn in front of Capstone Community Action in Barre, many holding signs that read "Tax Reform and Climate Action." Representative Johannah Leddy Donovan of Burlington stepped up to the podium and began a statewide conversation on "Tax Reform and Climate Action."

Rep. Donovan announced a proposal that would reduce the state income tax burden on all Vermonters, provide extra financial benefits for low-income earners and do something meaningful to address climate change.

Rep. Johannah Leddy Donovan, from the Capstone Community Action, speaking at the Tax Reform and Climate Action proposal event. Courtesy photo.

"Despite the tweets of our climate change denier-in-chief, Donald Trump, climate change is real… Putting a price on carbon pollution will speed our transition to the clean energy future," she remarked. "This proposal will reduce taxes…and replace them with a gradually rising fee on the pollution that is causing climate change and threatening the Vermont way of life."

Rep. Donovan's proposal is one of four "short form" bills recently introduced into the legislature that call for a fee on fossil fuels. Representatives Sarah Copeland-Hanzas (Bradford), Diana Gonzales (Winooski) and Martin LaLonde (South Burlington) are sponsoring the other three bills regarding sales tax elimination, carbon dividends, and property tax relief, respectively. The four proposals were unveiled simultaneously on April 10, 2017 at four different press conferences across the state. Their primary purpose is to ignite serious discussion about the need for broad, more equitable tax reform that also addresses the pressing crisis of climate change.

"Our bills are conversation starters," said Rep. Donovan, a member of the tax-writing Ways and Means Committee and Chair of the Working Vermonters Legislative Caucus. "Because President Trump's budget will wreak havoc on Vermont, we need to have a conversation about aligning our tax code with Vermonters' needs and priorities."

Rep. Donovan's bill (H.528) proposes reducing the personal income tax rate for the lowest income tax bracket (from 3.55 percent to 1.75 percent) – a benefit all working Vermonters would realize. Her proposal would also double the state's Earned Income Tax Credit – one of Vermont's most powerful anti-poverty initiatives for working families, assisting over 40,000 low-income households each year. Vermont businesses earning less than $400,000 annually would also be exempt from the corporate income tax under Rep. Donovan's proposal. Each of these money-saving, income tax relieving benefits would be offset with a fee charged to fossil fuel distributors, making the policy revenue-neutral.

The sales tax elimination bill (H.533) sponsored by Rep. Copeland-Hanzas proposes cutting the statewide sales and use tax (currently at 6%) by one percent each year over six years. Revenue replacement would come from a gradually rising fossil fuel fee.

Rep. LaLonde is proposing a reduction in statewide education property tax rates paired with revenue replacement from a carbon pollution fee (H.532).

These three bills are *Cont'd on p.30*

Everyday Bicycling

By Karl Kemnitzer

Bellows Falls Community Bike Project first anniversary celebration. Photo by Karl Kemnitzer.

Reaching our transportation energy goals is often postponed until after we have weatherized our homes and installed solar panels, but since it is the largest energy use (37%) and emissions source (46%) of any Vermont energy sector, it should be one of the first places we look. With transportation, renewable energy, and industry all using similar electronics, batteries, and motors, we should expect innovations to happen simultaneously across all sectors. Change is happening now in transportation, and just as in renewable energy, it's not a question of whether it's possible, the problem is our old infrastructure.

As we reinvent transportation, we shouldn't forget that the cleanest and most efficient vehicle of them all is the bicycle, or that humans are made to walk. Active transportation has so many financial, health, environmental, personal well-being, and societal benefits that it deserves a much larger place on our roads then it has had in the past. In Vancouver, they found that if a pedestrian spent a dollar on walking, the city spent 1 cent to support them, a bicyclist cost the city 8 cents, a bus ride was $1.50, and for a personal car the city paid $9.20. In Helsinki, they found that for every Euro spent on biking facilities, the return to the city was 7.80 Euros. Many studies have shown that regular bicycling will extend your life by half a year or more while improving how you feel both physically and mentally (a medical benefit of around 20 to 1). Bicycles emit around 1/10 the lifecycle emissions of cars and use less than 1/10 the energy. They wear out the roads less than 1/1000 as fast as a car. Their infrastructure costs a small fraction of car infrastructure. They knit together downtowns and promote local economies. They've been shown to be faster than traffic in both Burlington and the Norwich, VT- to-Hanover, NH rush-hour commute. They are socially equitable and inclusive. They promote connection to place and neighborhood cohesion. It's been our loss that we have not kept a lane open for everyday bicycling.

After 90 years of car-centered road policy, it's time to actively support bikes. In addition to bicycling's benefits, we now have electric bikes that enable more people to ride, and new car-share plans for those who only need a car occasionally or during winter. Bikes can help meet energy and emission goals too, but in Vermont only 0.6% of commuters use a bicycle. We should be aiming for 10% or more like many northern European areas. I've proposed "An Act to Promote Work and Commuter Bicycles" which would exempt them from sales tax. It is VT House Bill H.355, cosponsored by John Bartholomew and Mollie Burke. I have estimated an annual

Cont'd on p.7

Drive Electric Vermont

Take Action on Transportation

By David Roberts

Transportation is now the single largest source of greenhouse gas emissions in the United States. Taking advantage of more efficient transportation options can save your household money, reduce fossil fuel consumption and support a healthy lifestyle. Reducing transportation emissions on an individual basis is a challenge for many of us due to issues of cost and convenience in driving a car.

A common rule of thumb in energy transformation programs is to do efficiency first and then consider fuel-switching to less carbon-intensive sources. For transportation, the move to efficiency can come in many different forms. Choosing to live in a downtown or other location where you don't need to get into a car for all of your trips can drastically reduce your annual vehicle travel. There are on-line tools designed to help you consider your combined housing and transportation costs when buying or renting a home (e.g. www.locationaffordability.info). These tools show housing costs are often higher in downtown locations, but in many cases, the money you save on transportation makes living there a smart investment and benefits your quality of life through reduced time and stress of car travel.

Living in an area which has more services and conveniences can also provide opportunities to reduce or eliminate car ownership, which costs an average of over $500 per month per vehicle in the United States according to AAA, with the methods of calculation they use for ownership. Many regions have short term "car sharing" options available that can provide convenient access to a host of different vehicles when needed. (e.g. www.carsharevt.com , www.zipcar.com, www.turo.com)

ZIPCAR CAR SHARING WEBSITE

If you aren't planning a move anytime soon, there are still many opportunities for transportation efficiency. Planning out your trips to link together shopping and errands can bring significant reductions in vehicle travel. Commuter carpooling has entered the modern age with many websites and apps offering new ways to match your travel needs with others in your area to share a ride. Transportation network companies like Uber, Lyft and Bridj are offering services which pool trips (although, in some cases, not every area with these services has access to the shared ride options). In Vermont, the Go Vermont program has a dedicated carpool matching resource which can help you get connected with others making trips in your area (www.connectingcommuters.org/carpool/). Neighborhood communication platforms like Front Porch Forum and Nextdoor can also be a good place to check with your neighbors on sharing rides to work or other trips.

Many employers have commuter-benefit programs for employees to reduce the need for parking and expand the talent pool for their workforce. Some areas have formed Transportation Management Associations (TMAs) that offer special programs to increase carpool and transit use, such as reduced or free transit fares, rewards for not driving alone to work and, in some cases, even providing a "cash out" to employees who do not need a parking space.

Taking a bus or rail option is easier than ever with Google and Apple incorporating transit trip planning into their mapping apps and websites and many operators offering real time information on the location of their vehicles, so you know when the next bus will go by your stop. Many of these same apps will also make it easier to plan a bicycle or walking route that avoids high traffic roads that may not be comfortable for many of us.

GOOGLE MAPS BIKE ROUTE EXAMPLE

If you are stuck owning a vehicle, you can still drastically increase your efficiency by switching to a plug-in electric vehicle (EV). EVs are getting more affordable and offering more range per dollar than ever. EVs are more efficient and less polluting than nearly every gasoline or diesel powered model in the northeast, even taking into consideration the source of the electricity. Charging an EV at home is as easy as plugging into a standard 120V outlet or upgrading

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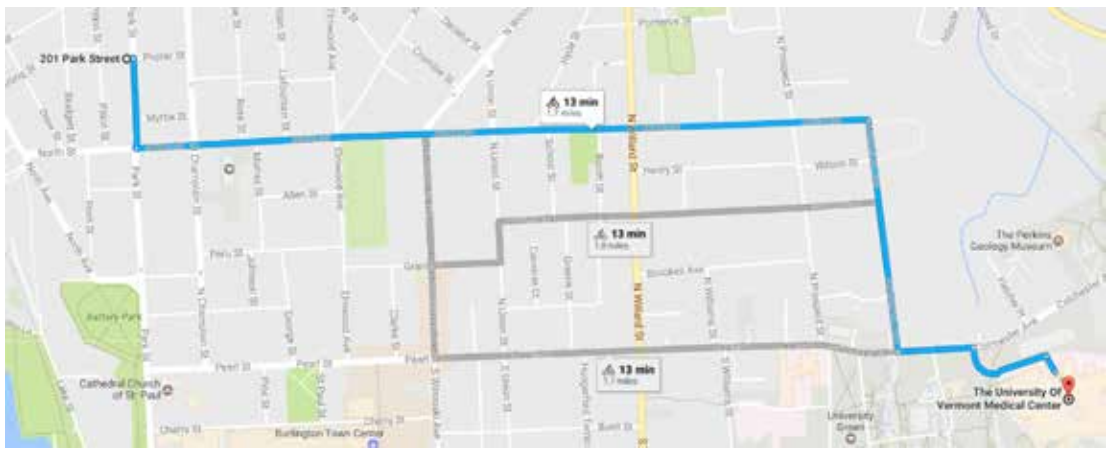


The route from 201 Park St, Burlington, VT 05401 to The University of Vermont Medical Center is 1.7 miles. It would take 13 minutes to get to your destination—on a bicycle.

SMART COMMUTING IN NH & VT

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 carpools, 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**

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/**

WINNIPESAUKEE TRANSIT SYSTEM (WTS) - Services Belmont, Franklin, Tilton, Laconia. 603-528-2496 **bm-cap.org/wts.htm**

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 advantage 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, Poultney 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**

HOW HAS GOING ELECTRIC (CAR, NOT GUITAR) CHANGED OUR LIFESTYLE?

By Barb and Greg Whitchurch

Short answer: it hasn't. One year ago we bought a 2008 Toyota Prius with 107K miles for $6,600. Last October we bought a 2015 Nissan Leaf with 33K miles for $12K. (The 2013 Leafs have just come off their three-year leases and are available for even less. http://bit.ly/GET-EVs)

As the female of us observes, our Prius is charcoal gray with matching interior, whereas our Leaf is charcoal gray with an off-white interior. The Prius shows off our Great Pyrenees' white fur, while the Leaf shows off her muddy paw prints. The male of us notes that the Prius is now our "truck": carrying 300 board feet of eight-foot cedar or 10-foot lengths of pipe

We marvel at both cars' abilities to climb our steep driveway even when it's icy, and we're pushing along in six inches of snow. The drive train distributes power only to the wheel with traction and won't spin it, even if we push a little too hard on the pedal. The female of us is thrilled with their stability on snow and ice. (Living back in the woods on a dirt road, we're familiar with standard transmissions and all sorts of drive systems.) With the continuously variable transmission in the Prius and the direct drive tranny in the Leaf, there's no more taking a run at the hills, downshifting, etc. Similar to cars with continuously variable transmissions,

Left: Barbara delivers Green Energy Times, what they consider *the "real news" paper, with their all-electric* Nissan Leaf. *Below: Bailey has plenty of room while she waits out of the rain in her hybrid dog house.*

- with the hatch closed! It has a tow hitch for a bike rack or a small trailer and a snap-on roof rack for big stuff on top. While the Leaf can take 10-foot lengths of tubing as well, its interior is not bulk-load friendly.

We use the Leaf for 95% of our driving needs. It seats us and Greg's parents comfortably, with the dog in the back. This covers any excursions less than 75 miles in winter. We save the Prius for longer trips or for when we need two cars at once. In warmer weather the Leaf's range increases, further reducing our use of the gas-hog Prius. (bit.ly/2odsFC7)

Compared to gasoline engine cars, our Leaf has: an enormous amount of torque; extra instant power at any speed; it's non-polluting; it's very quiet; and very cheap to drive. Like the Prius, it can't fail to start on even the coldest VT mornings; no oil spots in the garage; it can pre-heat or pre-cool the interior without polluting; no timing belts, rings, valves, starters; no need to warm up the engine before driving. (We know, gas cars don't need to warm up either, but a lot of folks still think they do.) There are hefty new-car incentives that reduce its already mid-range pricing and used models go for far less than similarly equipped gas cars. (bit.ly/2n1RTTO)

the Prius finds the most efficient ratio for any load situation in real-time, with no drop-outs, jumps, surges, etc. Both are verrrrrrry smooth.

Both cars have backup cameras, but our Leaf has "Around View" with four cameras giving a complete picture of the car's surroundings on the dashboard: parking space lines, curbs, etc. Its maps show charging station locations. It syncs with our cell phones, has audible directions for destinations, heated this-'n-that; and lots more stuff we really don't need.

There are 158 charging stations in VT - up by 14 since we bought the car. (DriveElectricVT.com/) We slow-charge the cars at home from a standard garage outlet. We deliver Green Energy Times to 50 central VT locations in our Leaf. If you spot our "EWHEELS" plate, give us a honk!

Barb and Greg Whitchurch are board members of VT Passive House and owners of a passive house in Middlesex, VT http://bit.ly/2nRCdGL

NASCAR VS. LEILANI MÜNTER

Cont'd from p.1

Bob Weir puts a Grateful Dead sticker on the bumper of Münter's car before she took off for the Lucas Oil 200-mile ARCA Series race at Daytona International Speedway. Münter, who was towards the front of the pack for most of the race, got caught up in a wreck late and finished 19th. Photo: H/T Relix (bit.ly/relix-weir-munter)

bumble bee, a young, female biologist is an improbable race car driver, but, again like the bumble bee, Münter excels in her sport and in her advocacy through sheer persistence. "No" is simply not in her vocabulary.

She is an uncommon messenger. "It was difficult for some of the old-school NASCAR drivers and viewers to take a young, female vegan seriously as a competitor," said Müter with a smile as she reflected on her racing career during a presentation at Green *Builder Media's* recent Sustainability Symposium 2017: Ready for Anything.

"Oh, but I didn't stop there—I gave them more to digest," she said. "In 2006, after I saw the movie Inconvenient Truth and became very upset about the unremitting degradation of our planet, I took my personal concerns about our environmental situation public. I started speaking out and posting environmental news on my website. In 2007, I even announced a commitment to adopt an acre of rainforest every time I sat in my racecar." (Leilani admits that offsetting is not a complete, long-term solution, but, for now, it helps to counteract the unavoidable impact from her racing.)

"The more that I learned about our environmental challenges, the more that my racing website ended up covered in facts about renewable energy, electric cars, alternative fuels, green buildings, plant based diets, and environmental legislation," she went on. "The reaction that I got from the racing community and the public was strong from both sides of the fence. Once I got past the personal attacks, I realized that my actions were stimulating a dialogue about climate action within the NASCAR crowd—I guarantee you that was the first time that the NASCAR audience had entered into a public debate about parts per million (ppm) of carbon dioxide in our atmosphere, which made me smile. I had started a dialogue, and that's the first step to facilitating change."

Münter is a strong supporter of plant-based diets (she is a vegan), electric vehicles (she is a proud Tesla owner and says that she will never go back to owning a fossil-fuel-powered vehicle), and total solar proliferation. She is aggressively pushing the racing industry to develop clean, electric solutions that provide speed without burning fossil fuels.

She was told by many people in the racing industry that she was making a big mistake by combining her passion for racing with a solid, vocal commitment to environmental activism. "I was told to shut up, drive my car, and plug my sponsors," she said. "Marketing experts told me that by talking about political and environmental issues, I would alienate myself from companies that might want to sponsor my race car—companies with CEOs that don't believe in climate change. And I said to them, screw you, watch me."

Münter doesn't waste any opportunity to talk about what she believes in, even if it means that she'll get sidelined. (As a case in point, she was recently banned from SeaWorld properties indefinitely for bringing roses and a sign to mourn the death of Tilikum, the 35-year-old orca held in captivity at SeaWorld in Florida, whose story was told in the popular documentary Blackfish.) If a sponsor doesn't want to support her cause of caring for the planet, she doesn't want said sponsor.

Fortunately, Münter is able to work with a spectrum of sponsors that are, like her, committed to climate action, including companies in the recycled paper, solar, wind, and LED lighting sectors, as well as important environmental documentaries like The Cove and Blackfish.

In 2014, her pit became the first in history to utilize 100% solar power. "We quickly found out that there are some unexpected benefits to using solar. For example, our crew no longer had to yell over the generators, which is a competitive advantage."

Her race car is now a 200 mile-per-hour billboard to promote shifts in our behavior. Her goal is to inspire race fans to rethink their daily choices and reduce their environmental footprint. "Just because race fans love racing does not mean that they don't care about planet earth," asserted Münter. "Liking fast cars and caring about clean air and clean water are not mutually exclusive."

She is on a mission to clean the sport of racing. She hopes soon to shift to a new electric race car (a modified version of the Tesla Model S,) which will give her the speed she loves without burning any fossil fuels.

Her goals are bold. "I won't stop until I see every race track powered by 100% renewable energy, every sponsor taking responsibility for their impact on the environment, every racing tire recycled, every race car abandoning fossil fuels for electricity or alternative fuels, and every race track concession stand offering vegan options."

Münter's biology background makes hers particularly interested in—and motivated by—the science of our changing planet. "Scientists predict that the human footprint on our planet may cause the loss of half the world's species by the end of the century. We're undergoing the sixth mass extinction that our planet has ever experienced. We're in a new geological period, the Anthropocene, which translates into 'The age of man.' Human impact on the planet has become so extensive that we are actually changing our fossil record."

Nonetheless, Münter is hopeful about the future. She believes that solar, vegan diets, and electric vehicles are pivotal in solving our climate crises, and she is encouraged by the fact that it only takes 10% of the population to back an idea to reach a tipping point that makes that idea inevitable.

Be sure to check out Münter at her most recent race, the ARCA Racing Series at the Daytona International Speedway at: http://bit.ly/Munter-Daytona.

Reprinted with permission from Green Builder Media. *Learn more at: http://bit.ly/nascar-climate or www.greenbuildermedia.com. The link to Green Builder Media's Sustainability Symposium 2017: Ready for Anything is www.greenbuildermedia.com/ready-for-anything-2017. Reach Sara Gutterman at sara.gutterman@greenbuildermedia.com.*

Leilani Münter uses her notoriety in the racing world to promote going 100% renewable and saving the planet. Photo credit: Scott LePage.

Everyday Bicycling

Cont'd from p.4

cost of $47,000, but numerous studies have shown paybacks of 2 to 10 times the amount spent on bicycling programs because of resulting health care savings. Although H.355 is a small step compared to the support we give to cars, it was cut in committee to include only electric bikes. Please write your legislators that we need a more balanced transportation policy that looks to where we are going, not where we have been. We use our cars every day because we've made it easy, now it is our job to make biking and walking just as easy.

UPCOMING EVENTS:

- **Upper Valley Electric Vehicle Forum** in September 2017 (like the one at the Montshire in 2014). We are looking for EV owners who would like to display their cars. Please contact me if you are interested. kkemvt@gmail.com or 802 436-3061.
- **The Vermont Walk/Bike Summit** will be held in the White River Junction area in April 2018! This biennial conference includes speakers, presentations, and displays. For more information please contact Rita Seto at Two Rivers Ottauquechee Planning Commission. rseto@trorc.org or 802.457.3188.

Karl Kemnitzer enjoys riding solar electric cargo bikes and is on the Sierra Club Upper Valley and V-Bike committees.

Take Action on Transportation

Cont'd from p.5

to a 240V circuit for faster charging. If you are concerned about range, you can consider a plug-in hybrid option like the Chevrolet Volt which goes about 50 miles on the battery before switching to gasoline when needed. More information on EV options and charging is available at www.DriveElectricVT.com, or by doing an internet search for electric vehicles in your state to find information on available incentives.

Many of us are concerned about the implications of government policy changes on clean energy programs. Reducing your transportation emissions is a great way to show your support for green energy options and save money while doing it!

David Roberts is the Drive Electric Vermont coordinator. He has driven an all-electric Nissan LEAF for nearly 5 years and says if you have to drive, drive electric..

David Roberts is the Drive Electric Vermont coordinator. He has driven an all-electric Nissan LEAF for the past four years and says, if you have to drive, drive electric.

Going Solar: Do Your Due Diligence

A Series: Part Three – Net-Metering Value

By Jonathan Teller-Ellsberg

This is the last in this three-part series that started in our December 2016 edition of* Green Energy Times*, followed by part 2 in February, 2017. You can read parts 1 and 2 at http://bit.ly/GET-12-16 and http://bit.ly/GET-2-17, on pp. 8-9.

Cost Per Watt (aka "apples to oranges")

Whether you prefer your solar to generate apples or oranges, be sure you know which you are getting. Photo by Dano, CC-By-2.0.

In addition to quoting the overall cost of your proposed solar array, an installer is likely to quote you the "cost per watt" of the array. So if the overall array costs $20,000 and the claimed output is 5 kW (5,000 watts), then your cost per watt is $20,000 divided by 5,000 watts, which equals $4 per watt.

What is this "watt" that is being bandied about? It is a measure of the ability of the solar array to produce electricity, if and when it is exposed to a standard intensity of sunlight (and subject to other standard conditions). So our hypothetical 5 kW solar array will produce a flow of 5,000 watts of electricity for as long as the sun is shining on it with that intensity. If the sunlight is less intense, then the flow of electricity will be reduced. Reduced intensity of light may be the result of clouds, haze in the atmosphere, or from the light coming in from a shallow angle. Nighttime doesn't help either.

What you really want from a solar array are the kilowatt-hours it can produce. The wattage of the solar array is merely a means toward this end. You are billed by your utility based on kilowatt-hours (kWhs), and a solar array saves you money only to the extent that it supplies kWhs.

That means that to properly compare the cost effectiveness of different solar proposals, you need to compare the "cost per kWh" of delivered energy. (See part one, "Predicted solar output," for a review of how much delivered energy to expect.)

For sake of mathematical simplicity, I recommend using "cost per first-year kWh," which is the cost of the array divided by the number of kWhs to be produced in the first year. Needless to say, your solar array will produce electricity long after the first year, and your long-term cost of electricity from the array will be on the order of pennies. Limiting the math the first year simply makes it quicker and easier to get a number that is useful for comparisons.

If the proposals you are considering are all for nearly identical arrays—say, on the same piece of your roof—then comparing their costs on a per-watt basis will give you pretty much the same result as comparing them on a per-kWh basis.

But if there are differences in how the proposed solar arrays will experience sunlight, then cost-per-watt is a misleading metric. Consider two hypothetical solar arrays:

This is a rooftop array 5 kW in size with a basically clear, due south view of the sky, which is reasonably expected to generate 6,500 kWhs in the first year. It costs $22,000. It has a cost-per-watt of $4.40 and a cost per first-year kWh of $3.38.

This is a rooftop array also 5 kW in size, but which faces southwest and which is partially shaded by a nearby tree. It is reasonably expected to generate 4,900 kWhs in the first year. It costs only $17,000. It has a cost-per-watt of $3.40, which is 22% less than option A. However, its cost per first-year kWh is $3.47, which is 3% more than option A.

Assuming you can afford option A, it is a better choice. For each dollar invested, it gives you more energy, which is to say more value. That is shown by its lower cost per first-year kWh.

Few solar installers include "cost per first-year kWh" in their proposals, but it is something you can easily calculate for yourself. As long as the proposal includes a reasonable prediction of electricity to be generated in the first year, you simply divide the total cost by the number of such kWhs. You can do this based on the total cost either before or after accounting for government incentives. Do the calculation the same way for all proposals, and you will get a useful, fair, apples-to-apples number with which to make comparisons of cost-effectiveness.

Financial Return

Many proposals include some version of financial analysis. The two most common are "simple payback" and "return on investment."

Simple payback is the estimate for the number of years until the value provided by the solar array adds up to the original cost. People can't help but like this measure, which gets applied to many energy-related investments, though it is a bit of an odd duck. When was the last time you asked for the simple payback on a mutual fund or a new roof?

Regardless, if you are going to compare predicted simple payback from different solar proposals, you have to make sure the proposals are apples to apples in all their essential elements. As noted above, the installer's assumptions on solar panel degradation and electric rate inflation, for example, can cause significant variation in predicted value. Any installer can make their solar array look like it has a seven year simple payback simply by cranking up the assumption of electric rate inflation and minimizing or ignoring panel degradation.

Return on investment (ROI) is calculated as:

- **Lifetime net metering value**
- **Cost of solar array**

Where the cost of the array probably is assumed to include any and all government and utility incentives that are available. The result will be in the form of a percentage. This is sort of okay as a measure of return, except that different installers will calculate it based on different lifetimes (for example, 20 years vs. 25 years vs. 30 years), making it no good for comparison purposes.

And some installers don't even calculate ROI this way. Instead, they calculate it as:

- **First year's net metering value**
- **Cost of solar array**

Cont'd on p.9

The right solar array can bring joy to the homeowners and their sheep too. Photo by Cody Berwick.

Going Solar: Do Your Due Diligence

Cont'd from p.8

Technically, this is not supposed to be called "ROI," which only goes to show that people in the solar business are in the solar business, not the investment advice business. But once a competitor starts claiming to offer double-digit returns, how can an installer avoid throwing some finance-y numbers into their proposals?

Anyhow, some installers avoid ROI, due to its many pitfalls (see the entry in Investopedia for more examples: http://goo.gl/kt8Me) or offer it as one among other forms of financial analysis.

Among the other forms of financial analysis, perhaps the next most common measure used by solar installers is "internal rate of return" (IRR). Like ROI, IRR is shown in the form of a percentage value. Unlike ROI, IRR can be used to compare the return on a solar investment with other types of investments, such as CDs, money market accounts, municipal bond funds, and so on.

The key technical advantage of IRR is that it takes into account the amount of time involved in the investment. For example, two investments which have the same up-front cost and which return the same monetary gain will have the same ROI, even if one of them provides the return in five years and the other in 20 years. However, the IRR will be higher for the first and lower for the second, in recognition of the fact that something that provides value to you more quickly is more valuable, all else being equal.

Conclusion

A solar array is a long-term investment. Solar equipment tends to be reliable and durable, but nothing is perfect. To the extent that you are able, you probably will want to enter into this sort of long-term business relationship with a provider you feel you can trust—and it's nice to use your money to support honest business practices, too, even if they aren't always the ones with the lowest sticker price.

Before you plunk down tens of thousands of dollars, or enter into a twenty-year lease agreement giving control over the very roof on your home to a distant corporation, take a little time to look carefully through the proposals you receive. Check to see that the predictions being made are reasonable and defensible.

A provider seeking to sell you an array has an interest in presenting optimistic versions of the different variables involved. And that might indeed be how things play out: utility rate inflation might be high, global warming might give us a sunnier climate, and your solar panels might degrade more slowly than the average.

But why set your expectations on only optimistic assumptions? If the numbers look good even with cautious assumptions (low inflation, traditional climate, maximum panel degradation), then you will sleep better with your solar purchase.

The keys here are double-checking the predicted quantity of electricity that will be provided by the array and the way the proposal translates that into predicted monetary value. When comparing proposals, be sure that predictions of energy production and monetary value are based on equivalent assumptions.

When in doubt, ask for explanations. No one knows the future, and the best any solar installer can do—even the most honest and cautious in the world—is give an educated guess. The best you can do is go into solar (and you should go into solar!) with reasonable expectations and open eyes.

When there is a huge solar energy spill, it's just called "a nice day."

Jonathan Teller-Elsberg works for Solaflect Energy, a Vermont-based manufacturer and installer of solar trackers. He has a master's degree in Energy Regulation and Law from Vermont Law School.

Southshire Community Solar

By George Harvey

Southshire Community Solar project array. Photo courtesy Bhima Nitta.

Bhima Nitta, the owner of Power Guru, in Bennington, Vermont, told us about a new community solar system in Shaftsbury, Vermont. The Southshire Community Solar project's first phase was completed in September of 2016. Now, a larger second phase is coming; construction will start in June for completion in September. The Certificate of Public Good application for phase II was filed in 2016, therefore the phase II falls under 2016 net-metering rules.

The Southshire Community Solar project (SCS) is based on the Boardman Hill project, which was finished in 2014 and got subscribers especially good returns on their investments. According to the Vermont Energy and Climate Action Network, Boardman Hill's subscribers paid a dollar per watt less than those of many other community projects. (http://bit.ly/boardman-hill).

Legal help for Boardman Hill, a very important part of the overall design, came pro bono from the Vermont Law School. The project's legal structure, fine-tuned a bit by the Vermont Law School, provided important basic elements for the SCS project.

The first phase of SCS had 23 families subscribing, along with two businesses and one non-profit organization. It has a capacity of 91.2 kilowatts (kW).

Now, with that success, the second phase is being readied. Its capacity is 240 kW, so it can have many more subscribers. Power Guru is developing the project, and in March, when we spoke to Bhima Nitta, the project was nearly 50% subscribed.

Each subscriber pays $825 for each share, though the price could end up being lower, and each share covers the installed cost of a single 300-watt solar panel. That comes to $2.75 per watt. Subscribers are limited to buying no more shares than would cover their power bills.

Renewable energy credits are an important issue. Bhima Nitta told us, "Original intent was to insure that the Renewable energy credits do not leave Vermont – the renewable energy credits will be owned by shareholders."

Like many community solar projects, a family or business that subscribes can apply for federal tax credits to cover part of the cost of their investment. Including a 30% incentive, the pay-back time is eight years for homeowners, or five years for commercial operations.

One problem with giving incentives in the form of tax credits is that people who have little income cannot benefit from them; they have no taxes to reduce with credits. Non-profit organizations can work with SCS for leases. But SCS is also interested in helping people with low incomes, who would otherwise find it hard to get solar power.

SCS has been engaging with Habitat for Humanity, the Bennington Coalition for the Homeless, and Shires Housing to establish the best approaches to helping low-income families have solar power. SCS is also finding ways for others to benefit. It is talking with the Second Chance Animal Center and the Park McCullough House Mansion, which provides educational programs.

One other aspect of the SCS work is that there is an intention to keep everything as local as possible. Bhima Nitta told us, "Local folks wanted to keep things local and were willing to pay a little extra for that."

The Southshire Community Solar website can be visited at http://bit.ly/southshire-community-solar. Power Guru's website is http://power-guru.com.

Two NH Campaigns Launched for Solar & Energy Efficiency

By Michelle Harrison

New Hampshire is welcoming spring with the launch of two clean energy campaigns, Energize 360 and Solarize Mt. Washington Valley. Both of these programs are for homeowners, business owners and non-profits in a given community to group-buy energy efficient products and save money. Energize 360 is a program for the communities of Dover, Durham, Lee, Northwood and Portsmouth. The Solarize Mt. Washington Valley campaign includes the communities of Jackson, Bartlett, Albany, Madison, Conway, Intervale, and Chatham New Hampshire; and Fryeburg, Maine.

Energize 360 was launched in March and runs until June 30, 2017. Energize 360 provides a suite of energy efficiency and clean energy options at bulk discounts.

Every participant in Energize 360 will get a free site visit, a Home Heating Index score, and a comprehensive analysis of their energy usage specific to their home or business. Energize 360 offers energy audits, weatherization, solar electric systems, heat pump installations, and more, as well as help qualifying for all available rebates and incentives. The Energize 360 program also includes funding for community projects in each of the five participating communities. The funds available for community projects and the discounts available to homeowners and business owners both increase as participation in the campaign increases.

Energize 360 is a partnership among Seacoast Regional Energy Hub, Seacoast Area Renewable Energy Initiative (SEA-REI), ReVision Energy, and Yankee Thermal Imaging. The participating program vendors were selected by an independent committee through a competitive bidding process that took into consideration competence and cost.

For more information and a list of Energize 360 program events, please visit energize360.org or call ReVision Energy at (603) 679-1777.

The other campaign taking place is the Mt. Washington Valley Solarize Campaign. This was launched in February as part of an effort to increase renewable energy in New England states. This campaign is being led by Revision Energy based in Portland, ME. The program offers a 5% discount off the solar electricity system and air-source heat pump installation for those who sign up by May 31, 2017. The 5% discount is based on the total system purchase.

To learn more about the Mt. Washington Valley Solarize Campaign, contact Brittany Angelo at (207) 221-6342 or bangelo@revisionenergy.com.

Revision Energy Team. Photo: John Capron of ReVision Energy.

Solar Power Is Now The Least Expensive Energy Option

Conventional thinking on energy costs has been stood on its head.

By George Harvey

In December, we got word from two different, highly respected sources, that the cost of solar electric power has now dropped so far, that it is now our least expensive power source. The sources, Bloomberg New Energy Finance (BNEF) and Lazard are both financial advisors. It is important to understand the implication of this; both organizations get their income on the basis of the accuracy of their analysis, so the axe they have to grind is to be correct.

News from BNEF came out with its data first in its report, Climatescope 2016 (see bit.ly/climatescope-2016). While the BNEF report said that the price of electricity generated with solar photovoltaics (PVs) had dropped to the point that it was the least expensive available, it also pointed out that emerging countries are spending more on solar power than wealthier ones. China is the leading solar PV installer. We might also point out that over half the new wind power installed in 2016 was in China.

The other report is Lazard's Levelized Cost of Energy Analysis – version 10.0 (see bit.ly/LCOE-2016). which provides the energy comparison (LCOE), for which Lazard is widely known. This deals with actual costs, derived from market activity in 2016, and it factors in subsidies. It shows solar power as marginally higher cost than its least costly energy source, wind power, for the full year of 2016. The cost of solar power is dropping much faster than the cost of wind, however, so it is clear that at year's end solar should be less expensive.

Here is some data derived from the LCOE table, which covers the entire year:

When we interpret these data, we do have to be careful to understand that generators have very different characteristics. Because of this, they have to be used differently as demand changes. Coal-burning and nuclear plants can take many hours to change their output. For that reason, the base-load power they provide is usually not much more than the minimum required for low demand periods. Combined cycle natural gas plants can change more quickly but still require many minutes to hours to get going. Peaking natural gas plants are yet quicker in their response times, taking only a few minutes. Energy flow from batteries can be turned up or down in fractions of a second. In the end, the load has to be balanced, so all these resources have been used.

In New England, the typical day's high demand for electricity is about 150% of low demand. The high demand period happens to coincide with daylight times and early evening. In the past, peaking natural gas plants were used to cover part of this difference, at an average cost, the data shows, of $191/MWh. Competing with this is solar, at about $53/MWh, when the sun shines, and solar with storage at $92/MWh when it is not. Clearly, there is less reason to use peaking natural gas plants on days when the sun shines and evening, following sunny days, because of the enormous savings solar power offers.

With decreasing costs of solar power, the shift to solar power for peak demand times has already been underway for a couple of years. With the added impetus from lower storage costs, we can now expect a somewhat more rapid shift away from natural gas to supply peaking power on sunny days.

We have an ability to anticipate those times when the sun will not shine, and this means high demand times on cloudy days can be anticipated. Also, cloudy days tend to have lower peak demand than sunny days. These being the case, it seems likely that peaking natural gas plants will not be used much on those days either. This is especially true with increases in available wind power.

Prices per megawatt hour	*Low*	*High*	*Average*
Onshore wind	$32.00	$62.00	$47.00
Utility scale thin film PV	$46.00	$56.00	$51.00
Utility scale Crystalline PV	$49.00	$61.00	$55.00
Combined cycle natural gas	$48.00	$78.00	$63.00
Utility scale PV with storage			$92.00
Coal	$60.00	$143.00	$101.50
Nuclear	$97.00	$136.00	$116.50
Peaking natural gas	$165.00	$217.00	$191.00

We should note that solar power backed up with storage is also less expensive than power from nuclear and coal-burning plants. Solar power, in combination with storage, can now start competing with these traditional base-load power sources on a purely cost-competitive basis. And, as the costs of storage and solar continue to decline, we can expect that solar power will not only be the least expensive overall, but in the near future solar plus storage to be the least costly source of base-load power.

Unsurprisingly, according to the Energy Information Administration, an office of the Department of Energy, utility-scale solar accounted for 37% of all installations they tracked for 2016 (see bit.ly/new-capacity-2016). Since rooftop and small community installation are usually about 40% of the total for solar, it seems very likely that PVs accounted for about half of all new generating capacity in the country for 2016.

One Woman's Amazing Story:
Solarizing In The Upper Valley

By George Harvey


Kim Quirk

How many solar installers does it take to finish 53 home systems in a year? Answer: "Three, if they are a woman named Kim Quirk and two members of her crew at Energy Emporium." I struggle to describe what an amazing accomplishment this is. I could compare it to a stupendously complex juggling act, but that does not do it justice.

Talking with Quirk about organizing the Solarize Hanover, New Hampshire project, I came to understand that some kinds of engineering really are more like art. The underlying work of organizing a project, getting the right people to be at the right place at the right time, with the right equipment and the right tools, is rather like choreographing an elaborate dance. Everything must flow in a manner one might call elegantly beautiful.

Quirk said that the first problem for Energy Emporium's work in the Solarize movement was getting over the misconception that the business was too small. Given the chance to prove itself, however, in the case of Solarize Hanover, it installed 53 home solar photovoltaic systems for a total of 355 kilowatts of solar panels, in a single year. And more to its credit, its installations there will save about 9,500 tons of CO2 emissions over the lifetimes of the systems.

When she started working on the Solarize community projects, Quirk understood that a smaller business had the advantage of not having to maintain a large permanent staff. Energy Emporium is much smaller than one might expect, given the size of the job. There were a total of three employees who did all the site evaluations and worked with multiple sub-contractors to all the solar panels. Work that did not need the special skills of solar experts, including roofing, excavation, construction, and electrical wiring, was done by local, experienced independent contractors.

This approach means less overhead for the business, which in turn means that Quirk can produce more competitive bids on projects, saving customers money. Apart from that, however, it means that a lot of her time is spent making sure that things flow according to plan. The plan had to take into account not only such things as personnel and logistics, but also seasonal weather, maintenance of existing customers, along with all the other responsibilities of running a business.

In the Hanover project, everything started with doing almost 300 site visits in the three months between December of 2014 to the end of February 2015, a time when actual installation work would be difficult, at best. This was followed by a lot of lively activity for the next nine months, as installations had to be completed at a rate of two to three per week to have all 53 completed by the beginning of the next winter.

During the course of that rapid work, planning and execution had to flow like a New England contra dance. Each step had to be done precisely as ordered, executed precisely as designed, with perfect timing.

An important additional part of the installation process is making sure that all the homeowners know precisely what to expect. They have to be told when to expect workers to show up and when they will be able to see the systems they ordered completed, providing clean power and reducing the electric bills. "Open communications is the most important thing," Quirk said.

Starting in March of 2015, the 53 Solarize Hanover installations were completed before the following winter began. But the work was not over when all installations were completed in Hanover, because Energy Emporium had to move on to new work for Solarize Lebanon-Enfield. And so the elaborate grand ballet began once more.

Solarize Lebanon-Enfield had its own complications. The New Hampshire cap in net metering was hit just as installation work was underway, leading to delays. Nevertheless, 40 systems were completed, all within the allotted time. They total 283 kilowatts and will eliminate about 7,500 tons of carbon emissions. In this case, Kim Quirk had to switch her show to highlight patience and flexibility. With those, she and her company succeeded in providing the solar systems people wanted, despite regulatory delays.

For the future, Kim Quirk told us that people are beginning to move more and more toward battery based grid-tied and off-grid systems, because the prices of these systems will soon be low enough to be competitive, and they are not affected by net metering changes that we are now seeing.

For those interested, an earlier story on the Energy Emporium appeared in the April 2014 issue of Green Energy Times. It can be found at http://bit.ly/GET-April-2014-Energy-Emporium.

Energy Emporium's web site is http://www.energyemp.com/.

These and many more towns that were involved in the Solarize Upper Valley program have served to largely increase solar in the region, moving us closer to a clean energy future.

Top corner: Gisela Jones, Lebanon, NH; 6kW DC; 6,900 kWh/year; offsetting 142 tons of CO2; above: John Schumacher, Hanover, NH; 5.5 kW DC; 6,900 kWh/year; offsetting 142 tons of CO2.

Nancy Smith, Shaker Hill B&B, Enfield, NH; 8 kW DC on a 2 axis tracker; 13,500 kWh/year; offsetting 277 tons of CO2. Courtesy photos.

Pipelines? We Don't Need No Stinkin' Pipelines!

By George Harvey

One part of the problem: what happens when a pipeline explodes. Photo: Wikimedia Commons.

Costs for battery storage are falling much more sharply than most analysts anticipated. They have fallen so much in the last two years that they are already having effects on the natural gas market. An example of this can be seen at Aliso Canyon, where a 120-megawatt hour (MWh) battery was installed after last year's gas leak, to reduce dependence on natural gas. The effects are now projected only to become more pronounced and may soon be disruptive to the use of natural gas at the utility scale.

Two years ago, RenewEconomy published "Energy storage to reach cost 'holy grail', mass adoption in 5 years." (http://bit.ly/RE-energy-storage-projection) The article was based on projections from a paper published privately by Deutsche Bank and a paper from the Rocky Mountain Institute (RMI). The article claimed that the price of batteries would fall to a level that would be disruptive within five years.

We should note that electricity and batteries are both priced in terms of cost per kilowatt hour (kWh), but the values are not comparable. One is the cost of electricity, and the other is the cost of the equipment used to store the electricity. It is rather like comparing the cost of a certain quantity of oil with the cost of an oil truck that would carry that quantity.

RMI's 2015 projections for the cost of battery storage showed declines from about $700/kWh in 2013 to a projected cost of about $470/kWh in 2017. RMI expected the cost to decline to about $400/kWh in 2020.

The Deutsche Bank's projections showed steeper declines in the cost of electricity delivered by the battery. This may have been partly because the decline in battery prices would be accompanied by other improvements, such as improved battery life. The bank showed that the price of electricity from batteries would fall from about 14¢/kWh in 2015 to a projected 2¢/kWh in 2020.

Now, two years have passed, and we can see that the projections were rather far off the mark, as the costs of battery storage have fallen much faster than anticipated. Many people know that the cost of the 10 kWh Tesla Powerwall, which has wide appeal to households, has dropped greatly. At the utility scale, however, the Powerwall is not the least expensive battery available.

The example I will use is the Eos Aurora battery, which is available is sizes of 1000 kWh and larger. It has been installed widely and is the least expensive battery I could find. (http://bit.ly/eos-aurora-pricing)

While RMI expected a drop to $470/kWh in 2017, the price of the Eos Aurora battery was $200/kWh for systems below 40 MWh at the end of 2016, and $160/kWh for those that are larger. A one-MWh battery is expected to supply 13,000 MWh, virtually without maintenance. This comes to less than 1.6¢/kWh, not including marginal costs, over the unit's lifetime. It is not the cost of electricity, but the cost of holding the electricity. It is an added cost for the portion of the electricity that comes from the battery.

The Eos battery is not alone. Prices are being reduced by a number of companies. Green Energy Times had an article, The ViZn Flow Battery, in the December 2016 issue. You can find that online at http://bit.ly/GET-vizn-flow-batteries.

To see the implications of this, we could look to "Lazard's Levelized Cost of Energy Analysis – Version 10.0" (http://bit.ly/Lazard-LCOE-10), which was released in December of 2016 and based on figures from that year. That source gives the cost of utility scale solar power at a range from 4.6¢/kWh to 6.1¢/kWh, while the cost of wind power ranged from 3.2¢/kWh to 6.2¢/kWh.

However, if we take the cost of "24-7" power from solar power above and increase it for the cost of battery storage at 1.6¢/kWh for simplicity's sake, the combination comes into the range of 6.2¢/kWh to 7.7¢/kWh. These figures are actually high, because they assume a need to store for all of the solar power and are, in fact, an unrealistic maximum. Also, because the wind blows most when the sun is not shining, the battery power to back up solar and wind power is lower than the back-up solar alone. With hydro power and biogas also available, the lean times are further reduced.

The range in cost of 6.2¢/kWh to 7.7¢/kWh is far below the cost of electricity from natural gas peaking plants, which have costs ranging from 13.8¢/kWh to 22.2¢/kWh and are also inferior to batteries in their response times. It is well below the cost of nuclear power, which ranges from 9.7¢/kWh to 13.6¢/kWh. It is very competitive with coal, which has costs of 6¢/kWh to 14.3¢/kWh, and it is getting competitive with combined-cycle natural gas plants, which have costs ranging from 4.8¢/kWh to 7.8¢/kWh.

We cannot know how costs will change in advance. Solar costs have been declining at 30% per year. Wind costs have declined about 10%. Batteries have recently declined at over 25%, though the last years' declines seem much faster. Assuming average cost declines of 20% per year for solar, wind, and batteries, the combined cost of power could get to 3.2¢/kWh to 4¢/kWh by 2020. And the point when there is no reason to build natural gas plants or pipelines comes well before that.

One part of the solution: a battery system. Photo courtesy of Eos.

Why We Need Wind Power in Vermont and in the Northeast

By George Harvey

Some people never seem to tire of talking about how ruinous wind turbines are to our views of ridge lines. Unlike arguments about deaths of birds, property values, or "wind turbine syndrome," which can be objectively addressed, the question of views is subjective. It is hard to counter, "I just don't like how they look."

In the Northeast as elsewhere, we need to address climate change. Most people do not really understand the extent of damage that will come about if we do not. A paper from the Vermont Agency of Natural Resources, "Climate Change and Vermont's Forests," has this stark paragraph in it:

Species distribution is already changing at high elevations. Northern hardwood trees are now able to survive at increasing elevations, due to moderating temperatures, outcompeting spruce and fir trees. Climate and pest risk model predictions identify Spruce-fir forests as being vulnerable to increased warming. Only slightly less vulnerable are northern hardwood forests whose dominant species are sugar maple, yellow birch and American beech. These forests are expected to be nearly eliminated in Vermont, replaced by species that prefer the warmer drier conditions, such as oak and pine species. (http://bit.ly/climate-change-forests)

That means no maple syrup and no fall colors. It implies little or nothing in the way of apple production, and a far-reaching general change in what crops we can grow. It means a world that *Cont'd on p.31*

Sheep graze beneath wind turbines. Photo: Creative Commons

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.

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

SOLAR THERMAL INCENTIVES – PER RATED CAPACITY OF SYSTEM

- $0.40 per kWh/year for residential and commercial customers
- $0.80 per kWh/year for Special Category customers

***special customer category limited to municipalities, non-profit housing authorities, public schools., and non-profit hospitals and health care centers. All incentives are subject to availability and may change.*

Pellet Heating

- Advanced wood pellet heating systems -- $3000 per boiler
- Custom Rebate $1.25/ft2 of heated space, $60,000 max or $80,000 max for public/non-profit sector
- **Details at www.RERC-vt.org or call (877)888-7372**

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®)

- ENERGY STAR LEDs supported by Efficiency Vermont incentives available 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 - using participating* contractors

Appliances (must be ENERGY STAR)

- Dehumidifiers - $40 mail-in rebate
- Clothes Washers - $40 rebate for CEE Tier 1 qualifying models, $75 rebate for CEE Tier 2, 3 or ENERGY STAR Most Efficient
- Refrigerators - $40 rebate for CEE Tier 1, $75 for CEE Tier 2, 3 & ENERGY STAR Most Efficient
- Clothes Dryers - $50 to $400 rebate on select ENERGY STAR electric models

Heating/Cooling

- LP/Oil boilers & furnaces - $500 rebate*
- Smart Thermostats - up to $150 mail-in rebate
- solar hot water - $950 rebate post installation
- heat pump water heater - $600-$800 point of purchase discount
- central wood pellet boilers (excluding outside wood systems) - $2,000
- circulator pumps - $50-$600 point of purchase discount
- cold climate heat pump point of purchase discount

Residential New Construction

- enroll in Residential New Construction Service – up to $2,000 in incentives and free home energy rating and expert technical assistance throughout construction and eligible for ENERGY STAR label
- Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives (contact EV*)

Other Opportunities To Save

- Advanced Power Strips – coupons at register at participating retailers*
- Pool Pump – up to $600 rebate on qualifying ENERGY STAR models
- Meter Loan – borrow "Watts Up" meter to measure the electric consumption of your appliances
- Commercial Refrigeration Evaporator Fan Motors - $60-$100 each w/ point of purchase discoun

*1. *all rebates/incentives subject to availability, limits and may change – for complete incentives and requirements, and for participating retailers/contractors, visit efficiencyvermont.com or call 888-921-5990*

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

Commercial Solar Rebate Program

Category 1:

≤100 kW AC incentive levels for PV systems:

- $0.70/watt (lower of AC and DC) for new solar electric facilities (Step 1 application received prior to September 1, 2016);
- 0.65/watt (lower of AC and DC) for new solar electric facilities (Step 1 application received on or after September 1, 2016);
- 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: The C&I Category 2 solar rebate program currently has 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 PV Rebate Program

- Rebates for solar electric/thermal projects 10kW (or thermal equivalent) or less
- New Solar PV = $0.50/Watt DC or 30% of total project cost, whichever is less. Max $2500.
- Expanded Solar PV = $0.50/Watt DC or 30% of total project cost, whichever is less. Max $2500.

Contact jon.osgood@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

- 40% of the heating appliance(s) and installation cost, up to a maximum of $65,000. An additional 30% up to a maximum $5,000 is available for thermal storage.

Systems must be 2.5 million BTU or less

Residential Wood Pellet Boiler/Furnace

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

Contact 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.

Renewable Energy Incentives Offered Through the NH Electric Co-Op

PLEASE Check for UPDATEs with NHEC.

Incentive programs discontinued for 2017:

- Commercial Solar Thermal (Hot Water)
- Residential Solar Thermal (Hot Water)
- Commercial Solar PV
- Residential Solar PV.

Residential and Commercial Heat Pump Water Heaters

- $500 for 50 gallon units and $600 for 80 gallon units
- up to $500 per ton on Energy Star© certified units

Planned for the 2017 Program Year: EV Incentives for Electric Vehicles

PAREI

To explore the possibility of a solar installation. Plymouth Area Renewable Energy Initiative. www.plymouthenergy.org

- **WWW.NHSAVES.COM**
- **WWW. NHEC.COM**

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

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 compre

hensive 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/residential/retrofit.html for more information and an online Home Heating Index calculator

NH ENERGY STAR HOMES

Incentives for builders of new homes who meet ENERGY STAR guidelines. Incentives include HERS rating fee paid by the utility, rebates for ENERGY STAR lighting, appliances and heating systems, and $800 - $4,000 additional incentive depending on the HERS score.

Visit www.nhsaves.com/residential/homes.html for more details.

NH ENERGY STAR APPLIANCES & LIGHTING

Mail-in rebates for ENERGY STAR-rated clothes washers ($30), room air conditioners ($20), room air purifiers ($15) and refrigerators ($20).

Visit www.nhsaves.com/ for more information and rebate forms.

Instant rebate coupons ranging from $1 to $7 for ENERGY STAR-rated CFL and LED light bulbs purchased through qualifying NH retailers.

Visit www.nhsaves.com/residential/es_lighting.html for more information.

NHSAVES Lighting and Efficiency Catalog

Extensive catalog of efficient lighting products, from stylish lamps to hard to find specialty bulbs. Catalog includes other efficiency items such as smart strips, power monitors, and water-conserving devices

Offered at discounted pricing for NH electric utility customers, and fulfilled by EFI.

Visit catalog.nhsaves.com/ for an online version of the catalog.

2014 ENERGY STAR® Residential Heating, Cooling, & Water Heating Equipment Rebate

Rebates of up to $1,500 on high efficiency Furnaces and Boilers, $200-$500 rebates on Mini Split Heat Pumps, up to $800 rebates on water heaters, rebates on programmable and Wi-Fi thermostats

Program details and application at www.NHSaves.com/heatingcooling

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 year 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-basement 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

www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program Please call 866-527-7283 to schedule a free home energy assessment.

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: atticwall-basement 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.**

MASSACHUSETTS 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 www.masssolarloan.com/loan-support-incentives.

DEPT OF ENERGY RESOURCES

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.

On Jan 8, 2017, these factors will be reduced by 20% until the new incentive program starts. Expect a new incentive program in late 2017.

http://bit.ly/Mass_SREC_II.
MA State Incentives can be found at: www.masscec.com/get-clean-energy

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH nyserda

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 NYSERDA:

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

New York State Energy Research and Development Authority.

- Business & Industry
- Communities & Governments
- Partners & Investors
- Cleantech & Innovation
- Residents& Homeowners

DISCOVER YOUR HOME'S 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

Find a Commercial/Industrial Solar Installer

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

Find a Residential/Small Commercial Solar 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 geothermal installed 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/Researchers-and-Policymakers/Electric-Vehicles/Electric-Vehicle-Programs.

OUR PROSPERITY DEPENDS ON PROTECTING THE PLANET

Interview with Geoffrey Heal | Union of Concerned Scientists (UCS) www.ucsusa.org

Geofrey Heal. Photo: © European Union

Geoffrey Heal is a UCS board member, a professor at Columbia business school, and a leading expert on economics in the environment. He chaired a national Academy of Sciences committee on ecosystem services and is a coordinating lead author for the Intergovernmental Panel on Climate Change. He is also the author of 19 books including Endangered Economics: How the Neglect of Nature Threatens Prosperity, recently published by Columbia University Press.

Your new book, "Endangered Economies," makes a compelling argument that our current economic systems don't adequately take into account our dependence on the natural world. Can you explain that a bit more?

GEOFFREY HEAL: The natural world provides everything we depend on. We get our food from the natural world, we get our drinking water and our oxygen from the natural world, and we evolved as part of it. We simply can't live without it. Plants create food, and they need pollination from insects, and they need rain, and they need soil. We can't synthesize these things. So we really are totally dependent on the natural world in the end.

The strange thing is that people don't acknowledge that more. You know, most of us now live in cities. We don't see much nature. We are very embedded in our latest technologies, such as our computer networks and our cell phones. There's a sense that we're so technologically sophisticated that we don't depend on the natural world anymore. But that's actually not true: we need it as much as our ancestors did and for the same reasons.

So, what do you see as the consequences of ignoring nature?

HEAL: Well, quite simply, if we don't make some changes in the way we organize our economic systems, I believe we will see catastrophic environmental change in our lifetimes—catastrophic for us. The good news is that, by making a few very achievable alterations to correct some egregious flaws in our economic system, we can go far toward ending this threat to our environment and our prosperity.

Let's talk more specifically about this. In the book, you call climate change the "greatest externality in history." What do you mean by that?

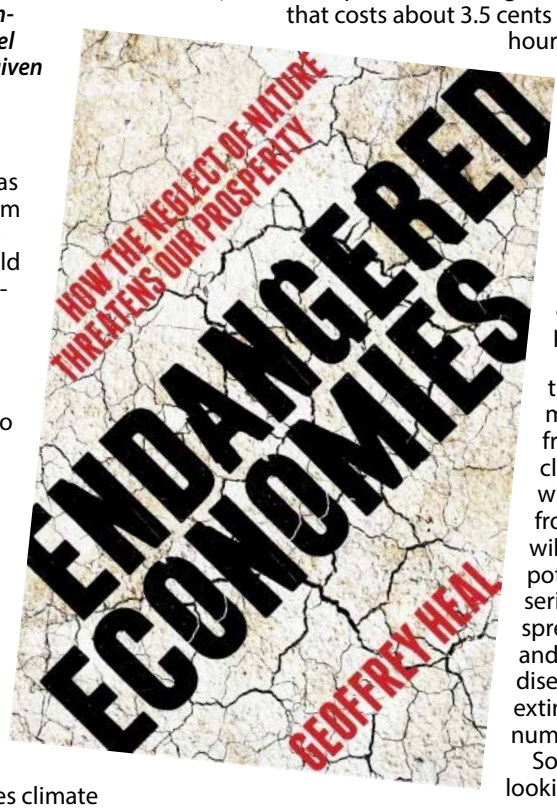
HEAL: An "externality" is a word economists use to describe a situation in which my actions impose a cost on you, but that cost is one that I don't take into account. So, in the case of climate change, if you're an oil company and I'm a consumer buying gasoline for my car, neither of us takes into account the fact that this gasoline will change the climate. It is external to—or omitted from—the transaction. People who burn fossil fuels impose costs on virtually everyone else in the world by changing the climate. It's a massive impact because it is affecting every being in the world, changing the planet for everything that is alive on it.

One of the key points I make in the book is that external costs pose the biggest threat to the environment, because they prevent nature and the economy from working together. We simply can't afford to continue to ignore this harmful error in our economic policies. The good news is that there are many ways to solve a problem like this.

In other words, you're saying there's a numbers-based, economic case for profiting from the conservation of the natural world?

HEAL: Absolutely. There's a moral case for protecting the environment, of course, but I show in the book that correcting some relatively basic errors in the way we account for things can make a world of difference in terms of dollars and cents. I'm arguing, essentially, that we need to get back to our fundamental capitalist principles. For an economic system to be viable in the long run, we need to make certain that everyone's accounting is done properly, to account for all the costs they generate. That's the way an economic system is supposed to work, going back to Adam Smith's ideas in 1776 in The Wealth of Nations. But we've drifted away from it. We are letting too many people forget some of the important costs that they impose on us.

There's some prescient discussion in your book about the power of the fossil fuel lobby and anti-environmentalism in the fossil fuel industry, especially given the recent election.



HEAL: Yes. Environmental issues really only became as partisan as they seem to be now relatively recently, since Ronald Reagan and coinciding with the rise of power of the fossil fuel industry.

A lot of the problem frankly has to do with the attempted manipulations of science by the tobacco industry and more recently the fossil fuel industry. These industries have sought to cast doubt on the scientific evidence that smoking causes cancer and that burning fossil fuels causes climate change. They have worked so hard to accomplish this that people have become reluctant to take that scientific evidence at face value.

One of the striking things in your book is your contention that preserving the natural world need not be expensive.

HEAL: Right. Let's take the concrete example of climate change: we all know that, to avoid the worst consequences, we have to move significantly away from fossil fuels. Well, today, the cheapest ways of producing electricity in significant parts of the world are by using wind and solar. In the southern United States, you can produce solar power for roughly four cents per kilowatt-hour; in the Middle East you can produce it for about three cents, whereas natural gas will cost you five or six cents, and coal and oil will cost even more than that. The least expensive power stations in the United States today are wind power stations generating electricity that costs about 3.5 cents per kilowatt-hour—roughly half the price of what it costs from the latest efficient natural gas power station, even at a time when natural gas is selling at a historically low price.

Plus, of course, the cost of not moving away from fossil fuels is clearly associated with huge costs from sea level rise, wildfires, droughts, potentially more serious storms, the spread of tropical and subtropical diseases, plus the extinction of a large number of species.

So, anyone looking at the full economic picture can see that changing to clean energy is going to lower our costs rather than raise them. There is an investment we have to make in new equipment, but once we do this our energy will be less expensive. The picture becomes even clearer if we count these costs currently considered "externalities," if we consider the economic value of the natural capital involved in our economy, and if we shift the way we make economic measurements to more fully represent what's going on.

My point is that some of these simple changes that I elaborate on in the book can go far to allowing humans and nature to prosper together.

Image: theconservation.com

Thousands Of Jobs Available!

Cont'd from p.1

Jessica Kilroy - hanging out at work. YouTube screen shot.

jobs in the other areas of renewable power and energy efficiency are not growing that fast, general renewable energy jobs have been growing at a compound annual growth rate (CAGR) of 6% per year for the past five years. By comparison, jobs in the fossil fuels industries have declined, with a CAGR of -4.25% over the same period.

In the Northeast, Massachusetts has been a leader in creating new clean energy jobs, which include not only renewable power, but also such things as building efficiency and clean transportation. The Massachusetts Clean Energy Center issued its own report, "Massachusetts Adds Over 6,300 Clean Energy Jobs" (http://bit.ly/MA-clean-jobs-report) in December, 2016. That report says that over 6,000 clean energy jobs were created in the state in 2016, bringing the total for the state to 105,202. The figure represents a 75% growth since 2010.

Many clean technology jobs pay rather well. The median pay for wind turbine technicians was $51,050 in 2015, according to the U.S. Bureau of Labor Statistics. Those of us who would not feel comfortable dangling off the tip of a blade of a wind turbine can take heart, however. There are lots of clean technology jobs. In Massachusetts, 70% of clean energy jobs are paid at rates above the median pay of all jobs.

We should make note that the growth of these jobs, and in fact some of the jobs already in the field, may be in peril on the short term, as the controlling interests in Washington want to reverse the decline in jobs in fossil fuels. At Green Energy Times, however, we feel fairly confident that the fact that sun and wind have come to be the least expensive sources of electric power, and the fact that grid-scale battery prices have been falling very rapidly, make it unlikely that coal will ever return to its earlier levels of importance. In fact, we see that natural gas and oil will likely decline, despite the support of the current administration for polluting power.

Some of us might feel a little depressed about the goings on in Washington. For those who do, we might suggest taking a look at the video in the first paragraph. Jessica Kilroy is an inspiration.

FACT: The U.S. coal industry shed 12,000 mining jobs—a 14% decline—from 2010-2016, while solar companies added more than 280,000 jobs in the same period, a nearly 300 percent increase.

- Department of Energy

VERMONT LEADS NATION IN SOLAR JOBS

per capita -- again

A new report by The Solar Foundation cites Vermont as a national leader in the solar industry, ranking third for the number of solar jobs per capita. Between 2015 to 2016, solar jobs in Vermont grew by 29 percent, with an additional 400 solar jobs created in the state last year.

"Each solar job means that a skilled craftsman, a recent college graduate, or an entrepreneur is able earn a stable living to feed their family, support their community, and stay in Vermont," said Olivia Campbell Andersen, Renewable Energy Vermont Executive Director. "The clean energy industry continues to stand out as a bright spot in Vermont's economy, bringing jobs to every corner of the State.

Solar jobs provide living wages, with the national median wage for solar installers at $26.00 per hour, according to the report.

"Vermont's solar workers are working hard to help their neighbors, farms, schools, and towns achieve energy independence and save money with clean, renewable energy," said Campbell Andersen. "Vermont's clean energy policies, particularly net metering, are critically important to ensuring access to electricity cost savings as well as maintaining jobs and growing our economy."

Visit www.revermont.org/resources/jobs/ for a listing of open positions in Vermont's clean energy economy.

The Solar Foundation's full report can be viewed online at www.solarjobcensus.org.

Solar Jobs Website

An interesting website for those who wish to check on employment in the solar industry is the "Solar Jobs Census 2016," (http://bit.ly/solar-jobs-census-2016).

Looking around on the web page, one can find a good deal of information, including the number of jobs in the solar industry in any given county.

The importance of solar energy as a job driver can also be seen on a report by the Solar Foundation, "U.S. Solar Industry had $154 Billion Economic Impact in 2016" (http://bit.ly/US-solar-economic-impact)

UCS RANKS VERMONT Second in NATION for CLEAN ENERGY MOMENTUM

A new report entitled "Clean Energy Momentum: Ranking State Progress" and published by the Union of Concerned Scientists highlighted Vermont for its success in developing a clean energy economy. Vermont ranked second nationally, only bested by California.

The report scored states on 12 metrics in the three broader areas of technical progress, direct visible effects on daily lives, and policies to build momentum for the future.

Vermont earned top-five scores in energy savings, electric vehicle adoption, and energy efficiency policy and 10 top: 10 appearances, the most of any state. The metric really stole the show with its clean energy jobs sector. Only nine states have at least 10 people per thousand residents employed in efficiency, solar, and wind. Vermont leads the nation in these clean energy jobs per capita.

All-and-all, the report indicates that the brave little state is punching well above its weight class, as it leads the nation with carbon reduction targets, hangs neck-and-neck with larger states such as California in energy efficiency (third place).

"Vermont's early and continued leadership on local clean energy - efficiency, solar, and wind has helped fueled our economy," said Olivia Campbell Andersen, Renewable Energy Vermont Executive Director. "Frugality, sunshine, and catching the breeze are staples of the Vermont way of life, and that is reflected in our energy choices. Given federal inaction, towns and states must lead the way on climate and clean energy solutions, and that's exactly what innovative Vermonters plan to keep doing."

The full report and press release can be viewed at: http://bit.ly/Vt-2nd.

Rick Perry-Lost in the Past

Cont'd from p.2

federal subsidies that boost one form of energy at the expense of others." And now we have another unstated assumption, which is that we should operate in a "free market," in which the government should not choose sides, but should allow the operation of the market full of big businesses, advertizing companies, and lobbyists, to choose whose product will succeed. "Those subsidies create acute and chronic problems for maintaining adequate baseload generation and have impacted reliable generators of all types." Perry seems to think, however, that the free market needs baseload generation that is powered by fuel. I am not sure how you can get there without choosing sides.

As governor of Texas, Perry oversaw the greatest build-out of wind power in the United States. And yet he seems not to understand at all that the times are changing. We are moving to a time when renewable power, a smart grid, distributed power generation, and new business plans are changing the world.

Coal is not being undermined by subsidies for wind and solar power. It is being undermined by the fact that its technology is obsolete. Given climate change and pollution, it is dangerous. It is too expensive. And no previous administration had anything to do with those facts.

Rick Perry just does not get it.

Rick Perry (Michael Vadon, Wikimedia Commons)

Sustainability in the Upper Valley

The Upper Valley (UV) region in New Hampshire and Vermont has many impressive sustainable programs and projects. We wanted to share with you some of the sustainable highlights in the region from what we know. Many town, business, and residents may learn from the happenings in the UV. There are likely more things going on in the region that are not listed. We will do a follow-up to this feature, so let us know what you know about sustainability in the UV that is not included below.

SOLAR IS HAPPENING ALL OVER THE PLACE...

Catamount Solar - Randolph, VT

Copeland Furniture, 500-kW solar, Bradford, VT. Photo: Isaac Copeland.

Involved with many projects in the UV. One of the most notable is the solar array at Copeland Furniture. See more on the front page of the August 2016 issue of G.E.T. (http://bit.ly/2pxQoyt) and p.10 of the October 2016 issue (http://bit.ly/2oJxqVH).

Energy Emporium - Enfield, NH

Energy Emporium home and office, 58 Main St., Enfield, NH. Courtesy photo.

Solarize Hanover program – installed 53 residential arrays totaling 355 kW offsetting 9,500 tons of CO2.

See more about Energy Emporium on page 13 of this issue.

Frase Electric - South Tamworth, NH

13.4kW residential solar - Lyme, NH

All projects listed are in Lyme, NH and are ground-mounted installations.

Single array, 5.5 kW, 6,000 kWh annually, 20 Solar Word 275W panels and 6 kW Solar Edge micro-inverters, 22,000 pounds of CO2 saved (equivalent of planting 555 trees).

Double array, both arrays together produce 15,000 kWh annually; front array is 6.6 kW using 24 Solar World 275W panels and a 6 kW SMA tranformerless inverter; the rear array is a 6.8 kW using 24 Solar World 285W panels with a 7 kW SMA transformerless inverter. Installed 2014 and 2016. Heat pumps are also installed.

Granite State Solar - Boscawen, NH

Canaan, NH: 10,060kWh annually, roof array, CO2 offset of 12.07 tons.

Enfield, NH: 11,680kWh annually, two ground arrays (one tracker and one fixed), CO2 offset of 14.02 tons.

Grafton, NH: 7,130kWh annually, roof array, CO2 offset of 8.56 tons.

Milhouse Enterprises - Belmont, NH

4.48kW Residential solar, Orford, NH. Photo: Emily Bryant.

All projects listed are in Orford, NH:

Five residential ground-mounted systems ranging from 3.36 kW to 7.7 kW, production from 4,400 kWh to 11,000 kWh annual production.

One roof mounted system of 4.48 kW, with 6000 kWh annual production.

Norwich Solar Technologies - White River Junction, VT

Kimball Union Academy, Plainfield, NH. Courtesy photo

Upper Valley Aquatic Center (UVAC 500), White River Junction, VT – 731.64 kW-DC, Generation: 914,550kWh, CO2 offset: 834,840 lbs.

Upper Valley Aquatic Center (UVAC 150), Thetford, VT – 227.8kW, Generation: 284,750kWh, CO2 offset: 259,932 lbs.

Cardigan Mountain School, Canaan, NH – 964 kW-DC, Generation: 1,200,000kWh, CO2 offset: over 26,000,000 lbs.

Kimball Union Academy (KUA), Plainfield, NH. 125kW-DC, Generation: 156,000 kWh, CO2 offset: over 150,000 lbs.

Pirouette Farms, Norwich, VT – 63kW-DC, Generation: 74,772 kWh, CO2 offset: over 1,905,863 lbs over 30-year production life.

Springfield Housing Authority, Springfield, VT – 207.9 kW, Generation 259,875 kWh, CO2 offset: 237,225 lbs.

O'Meara Solar - West Topsham, VT

Newbury, VT – 3.135kW - 3292kWh/yr, roof mount.

Bradford, VT – 10.26kW - 11,286kWh/yr, roof mount, and 6.84kW - 10,268kWh/yr, tracker mount.

Chelsea. 2.28kW array. Photo: Darren O'meara.

Haverhill, NH – 8.55 kW - 9,405 kWh/yr, roof mount, and 7.695 kW - 6,508 kWh/yr, roof mount.

Corinth, VT – 4.77 kW - 4,928 kWh/yr, roof mount; 7.42 kW - 8,489 kWh/yr, roof mount; and 8.1 kW - 8,837 kWh/yr, roof mount.

Chelsea, VT – 2.28 kW - 2,300 kWh/yr, ground mount; 3.42 kW - 3,500 kWh/yr, ground mount; and 2.29 kW - 2,000 kWh/yr, roof mount.

Royalton, VT – 5.13 kW - 5,363 kWh/yr, ground mount.

Thetford, VT – 5.985 kW - 6,321 kWh/yr, roof mount.

White River Junction, VT – 5.415kW - 5,100 kWh/yr, roof mount.

Saxtons River Solar - Saxtons River, VT

North Haverhill, NH: 12.8 kW off-grid system.

Saxtons River Solar Electric has installed two installations in the Upper Valley:

North Haverhill, NH - a 12.8kW off-grid solar system, on three ground-mounted poles.

Post Mills, VT - a 5.6kW roof mount solar with 6,062 kWh annual output.

Solaflect Energy - Norwich, VT

230+ Upper Valley PV tracker installations in a combination of residences, businesses, municipalities, schools, and libraries. These include participants in Solaflect Community Solar Parks. Their total PV capacity is near 1 MW, producing at a rate of approximately 1.6 MWh per year. To date, these trackers offset nearly 1,000,000 lbs of CO2 emissions throughout the upper valley.

Solar Source - Keene, NH

Solar Source - 5.5 kW solar PV system, Cornish, NH.

Cornish, NH – 12 solar arrays ranging from 2.75 to 8.415 kW, generating 2,970 to 9,088 kWh each year, offsetting 2.3 to 7.0 tons of CO2.

Cornish Flat, NH – 4 solar arrays ranging from 3 to 5 kW, generating 3,240 to 5,400 kWh each year, offsetting 2.5 to 4.2 tons of CO2.

Meriden, NH – 3 solar arrays ranging from 3.5 to 5kW, generating 3,780 to 5,400kWh per year, offsetting 2.9 to 4.2 tons of CO2.

Plainfield, NH – 6 solar arrays ranging from 2.5 to 10.5 kW, generating 2,700 to 11,340kWh per year, offsetting 2.1 to 8.8 tons of CO2.

SUSTAINABLE HANOVER

On December 14, the Sustainable Hanover Town Committee officially endorsed a transition to 100% renewable energy in Hanover, NH, for electricity, heat and transportation by 2050. A full vote by the Town of Hanover on the 100% renewable energy goal will take place May 9, 2017. If approved, Hanover would be the first city or town in New Hampshire to commit to 100% clean, renewable energy. The 100% renewable drive includes all energy used in town — in businesses, municipal services and private residences and vehicles — and would entail both producing the energy in town and, in large part, purchasing it from sustainable sources elsewhere.

The accomplishments of Sustainable Hanover are simply amazing. According to a December 15, 2016 news release from the Sierra Club Upper Valley, 22% of Hanover's energy use comes from renewable resources, including Dartmouth College, Hypertherm, Kendal at Hanover, and Dartmouth Printing. 2016 is the third year that Hanover has been recognized by the EPA as a Green Power Community.

There simply is not room in this article to do justice to the work done in Hanover. We will share more about Hanover's Sustainable plans in our next issue.

Hanover, NH police department: sunset on solar array.

OTHER SUSTAINABLE BUSINESSES IN THE UV

Colatina Exit of Bradford, VT is a Vermont Certified Green Restaurant. It recycles, composts, and buys locally to provide the best, fresh food and the lowest carbon footprint. It has diverted over 100,000 tons of waste from local landfills. Colatina Exit was reviewed in GET, you can read all about it at http://bit.ly/GET-Dining-at-Colatina. Or you can visit their website at http://www.colatinaexit.com/.

Chelsea Green Publishing of White River Junction, VT publishes books on the politics and practice of sustainable living. They print books and catalogs on chlorine-free recycled paper, using soy-based inks, whenever possible, and exclusively work with printers based in North America to keep their carbon footprint down. They are a member of the Green Press Initiative.

Copeland Furniture of Bradford, VT has also been featured in GET articles (http://bit.ly/GET-pollution-solution and http://bit.ly/GET-pollution-solution-update). In 2016, Copeland installed a 500 kW solar array that generates 850,000 kWh of electricity annually, offsetting 500 tons of CO_2. They are a member of the Sustainable Furnishings Council and awarded Silver Exemplary Membership status. Wood is locally sourced from sustainably grown forests. Heat is produced with wood waste from the manufacturing process.

COVER Home Repair and ReCOVER Store based in White River Junction, VT accepts donations of quality home furnishings, tools, and building materials, restoring them to new utility and value. Proceeds fund urgently needed home repair and weatherization for low-income families in the Upper Valley. Learn more at www.coverhomerepair.org.

Dan and Whit's of Norwich, VT, is a country store that walks the walk. It is solar-powered with 20, roof-mounted panels. It hosts an EV charging station, uses wood heat, and offers local goods. It reduces waste by donating any over-supply of sandwiches to the Appalachian Trail hikers and Willing Hands food-distribution agency. Oversupply of milk and eggs are donated to the Upper Valley Haven, a regional agency for the homeless. Dan and Whit's website is http://bit.ly/dan-and-whits.

Farm-Way of Bradford, Vermont, is 100% solar-powered. This sustainable family-owned business has also made many energy-efficiency changes to reduce their carbon footprint. It started its solar array in 2009 and enlarged it to cover all the store's needs. It has also put time and effort into cleaning up environmental problems in the local community, including getting rid of 19,000 gallons of tainted oil in local buried tanks and tearing down "the ugliest building in Bradford." It is associated with Vermont Gear, and its web site is www.vermontgear.com.

Home Comfort Warehouse in White River Junction, VT, offers solar, Mitsubishi heat pumps, EPA-certified wood and pellet stoves, and more. They recently participated in the Vermont wood stove change-out program that will reduce emissions considerably in the region. You can visit their website at bit.ly/home-comfort-warehouse.

Hypertherm based in Hanover, NH is a manufacturer with a mission. It aims to deliver shared value for people and for the planet, as well as for the company's profitability. The company believes reducing environmental impact is critical to its success. Hypertherm continuously studies the environmental effects of its products, operations, and supply chain. It has also established environmental impact reduction strategies for waste, energy, and carbon emissions to be achieved by 2020. These strategies help to guide decision making and strike a balance between meeting current needs and building long-term resiliency and success in an increasingly resource-constrained world.

Loewen Window Center of Vermont & New Hampshire, in White River Junction, VT offers high efficiency windows for high-performance buildings. It has appeared in GET's pages, in the articles, "Efficient Window Performance" (bit.ly/GET-window-performance), and "Remarks of a Windows Specialist" (http://bit.ly/GET-window-specialist). You can also visit the Loewen Window Center of Vermont & New Hampshire website at loewenvtnh.com.

Upper Valley Food Co-op of White River Junction, VT is a community-supported natural foods market. It carries local items whenever possible, and makes an effort to purchase from small, independent suppliers. Produce and products are primarily organic or natural.

Vermont Foam Insulation of Chester, VT has been a participant in the UV Weatherization program. Vermont Foam Insulation works with homeowners, builders and architects to provide superior insulation installation and energy efficiency contracting. It undertakes residential, commercial, municipal, and institutional projects, working on new construction and retrofitting. Over the past decade, it has installed over 100 Home Performance with Energy Star (HPwES) retrofits.

BUILDING EFFICIENCY

Building Energy – Williston, VT and White River Junction, VT

One example of Building Energy's homes is in White River Junction, VT. It is a single family residence, completed in July 2016.

A comprehensive energy audit was performed including a blower door test that revealed there were substantial opportunities to reduce

Cont'd on p.23

Building Energy - Laurel Lane residential project.

THE RIVER HOUSE
ORFORD, NEW HAMPSHIRE
Beautiful, Efficient Home Earns Architecture Award

By Barbara Whitchurch

The River House in Orford, NH captures the character of New England farmhouses and was sited to preserve as much farmland as possible, while providing views up and down the river. It's a four-bedroom home and large barn, which contains a studio apartment, an office, a workshop, a boat room, and space for equipment storage. More important than its aesthetics, though, is the fact that the energy usage of the house approaches net-zero.

In January, 2017, The River House received an Annual Excellence in Architecture Design Award from The American Institute of Architects, New Hampshire Chapter. The award recognizes "architecture that exemplifies excellence in overall design, including appropriate functionality, sustainability...and building performance." The architectural firm is Haynes and Garthwaite of Norwich, VT.

Byron Haynes, the architect, described the genesis of the design. "The owner was interested in energy efficiency, and he approached us because he knew this was the kind of thing we do: building a beautiful house and doing it responsibly." The owner was interested in solar PV; Haynes suggested solar hot water, too. Other sustainable aspects were the use of local materials whenever possible; recycled flooring; use of spray foam only when necessary; and only LED lighting.

Haynes chose Naylor and Breen Builders, who specialize in high-end residential building, for the construction. When I spoke with Brent Wilbur, the project manager, I asked him how they "approached net zero."

"There were many details that contributed," Wilbur told me. "It's built on a slab-on-grade; most of it faces south with lots of large, south-facing windows (Marvin Ultimate triple-pane). The solar installation is a combination hot water and 5kW PV. The home's radiant heat and hot water are supplied by a propane boiler. There is also a wall-mounted, ducted Mitsubishi air source eight-unit heat pump for supplemental heat and air conditioning."

The exterior is wrapped with two inches of polyisocyanurate; the inside is six inches of dense-packed cellulose, yielding an eight-inch-thick wall. In the attic and cathedral ceiling, extra insulation was blown in, and under the flat roofs, loose-filled cellulose was used. Closed-Cell Foam (CCF) was added under all the low-sloping roofs and around windows and doors for extra protection.

I asked Brent Wilbur what he learned from this project. "I'm now a lot more interested in building energy-efficient homes. And I understand the critical importance of air sealing to meet the required number of air changes per hour. Meticulous attention to taping can make a huge difference in the efficiency of a building." The blower door test yielded 1 ACH50; an average well-insulated home runs between 4 and 6.

Left: The River House. Exterior view shows solar photovoltaic system on the barn roof.Right shows the solar hot water panels on the house. Below is the bright kitchen interior. Photos from Carolyn Bates Photography.

The owner emailed Haynes the other day. "It's 5 degrees outside and I am padding around in my bare feet...the house is toasty warm." Byron added with a laugh, "The heat hasn't come on in the winter yet."

Read more about the River House at http://bit.ly/Rvr-hse.

Barbara Whitchurch is a member of the Outreach Committee at Passive House VT. She is also a freelance editor, writer and jewelry artisan from Middlesex, VT.

SUSTAINABLE UV *Cont'd from p.21*

air leakage and improve insulation in the attic. The upgrades performed resulted in 58% air leakage reduction, improved comfort, and ability to heat and cool with on-site solar electricity.

The upgrades included extensive air-sealing, insulating the roof and attic areas to R-52 and R-60; removal and sealing of a propane fireplace; installation of two Panasonic Whisper Green Select bath fans for effective moisture removal and mechanical ventilation; a Mitsubishi Hyperheat cold climate heat pump to reduce propane for heating; installation of a 5.2 kW solar PV rooftop array; and rerouting the oven exhaust vent to vent outside for health and safety.

R.H. Irving Homebuilders - Salisbury, NH

Bob Irving, of R.H. Irving Homebuilders, is an enthusiastic promoter of ecologically conscious building and can provide a wealth of information on home construction for efficient and comfortable living. One of the company's example homes is a residence built in 2017 in Cornish, NH. It includes super-insulation to R40/R60,

R.H. Irving Builder, high-efficiency home, Cornish, NH.

Intus windows, a quality wood stove, a standing seam roof, and corrugated Galvalum siding. It is lighted 100% by LEDs. It has a condensing dryer, an air-source heat pump, a heat recovery ventilator, and roof mounted solar panels to be installed. R.H. Irving Homebuilders was featured in "Green Builders in our Midst" in December of 2013 (bit.ly/GET-green-builders-12-2015).

Unity Homes - Walpole, NH

Unity Homes is a subsidiary of Bensonwood, which has been a leader in advanced home construction for many years. Its construction techniques, which include manufacturing components of homes in the environmentally-controlled environment of its plant in Walpole and assembling in the field, are widely studied.

An example of Unity Homes' work is in Hanover, NH at Dartmouth College. Four faculty houses were built as part of the project in 2016. They are located on campus to integrate faculty presence within student housing areas. The Unity Varm platform was used, a two-story Scandinavian influenced colonial of 3255 square feet. It features insulation in the walls at R-35 (12 inches thick; 9.25 inches cellulose insulation); a flat ceiling with insulation at R-60 (on the first floor); and truss roof insulation at R-60. The windows are Marvin Integrity triple glazed low-e (U 0.21). The foundation walls are insulated to R-15. The air tightness is 0.82 ACH 50 (average for four houses), and the HERS rating is 40.

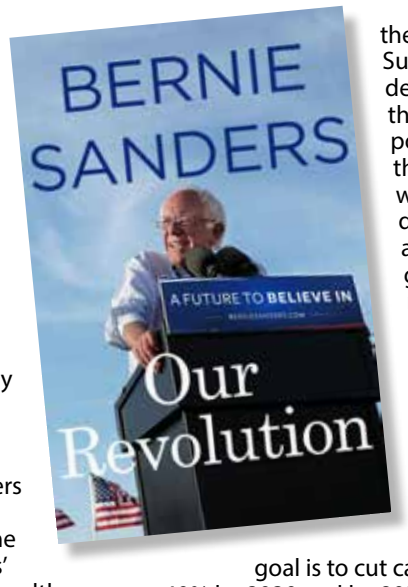
Vermod - Wilder, VT

An article on one of Vermod's projects appeared in the Green Energy Times' December issue of last *Cont'd on p.29*

Bernie Sanders' "Our Revolution: A Future to Believe In"

St. Martin's Press, November 2016, 464 pages, $13.50

Book Review by Roger Lohr



During the Bernie Sanders run for president, the book "Our Revolution: A Future to Believe In" provides perspectives of the progressive movement in the USA. Sanders gives us a brief biography, how his campaign for president was initiated, and an outline of his agenda to transform the country into a new America.

The book explains oligarchy, the decline of the middle class, and the rigged economy. Sanders gives lists of companies and individuals associated with who he feels are "the bad guys." Sanders' preference is for a single payer health coverage; affordable higher education; justice reform; immigration reform; protecting society's most vulnerable; and he also exposes the corporate media threat.

Climate change is explained in simple terms in the book, and Sanders showcases people on both sides of the issue including climate scientist Dr. James Hansen and 1,300 scientists of the Intergovernmental Panel of Climate Change, versus the Koch Brothers, Exxon, and associated Republican climate-change deniers.

"Our Revolution" for Climate Change

The science is clear and the majority of the American population supports addressing climate change. Energy companies have invested $2.2 billion in lobbying the politicians since 1999, and the Citizens United Supreme Court decision allowed the corporations to pour money into the political system without having to disclose how much and to whom it is given. The corporate media is supported (or owned) by companies that want to keep the status quo for their short term profits, so climate change is not often in the news. Bernie's goal is to cut carbon pollution by 40% by 2030 and by 80% by 2050.

How Bernie Would Combat Climate Change

"Our Revolution" lays out the strategies to take on climate change. Energy efficiency would be supported with Property Assessed Clean Energy Districts (PACE) that allow a utility or community to lend residential or business money to make efficiency improvements and then add the costs of retrofit projects to the beneficiary's energy or tax bill. Transportation (28% of emissions) efficiency would be addressed by a 65 mpg standard with incentives for purchase of affordable hybrid and electric vehicles. Infrastructure needed, such as charging stations, would be built and research of electric vehicles and advanced battery storage would be funded. Additionally, the progressives call for improvements to public transit systems.

Progressives would like to end government subsidies to the fossil fuel companies, and that represents $10 billion a year given to these companies in the form of tax breaks, direct subsidies, and lucrative lease and royalty agreements. The combined profits of Exxon/Mobil, Shell, Chevron, BP, and ConocoPhillips were $93 billion in 2013 and, in the same year, these companies received $2.43 billion in tax breaks!

Sanders proposed the End Polluter Welfare Act to save American taxpayers $130 billion over the next decade and to direct such funding toward the development of a clean energy economy, but there's no need to mention what happened to that proposal.

The Climate Protection and Justice Act of 2015 proposed taxing fossil fuel companies' emissions at the source of production and these funds would be given to the bottom 80% of Americans to offset expected energy rate hikes. The proposal would have invested in home energy efficiency, renewable energy production, clean energy research, and climate resiliency projects in low income and minority communities. The goal of this failed legislation was to make renewable energy options more attractive and competitive as the real cost of fossil fuels was realized.

Additionally, the progressive position supports a ban on fracking in general, and mining and drilling would be banned on public lands. Also banned would be new pipelines for oil-based products and mountain-top removal coal mining.

Concurrently, the government would invest in sustainable energy such as wind, solar, and geothermal using tax incentives to encourage new, clean energy generation projects. The solar investment tax credit and production tax credit have spurred the growth rate of solar energy, which has seen a 75% decrease in costs of solar panels since 2008!

The Solar Energy Industries Association claims that five million homes use solar energy for 27 gigawatts and prior to the Trump administration it had forecasted 100 gigawatts by the end of 2020. Wind now supplies energy to about 17 million homes for 75 gigawatts, and it was forecasted to generate 20% of the nation's electricity by 2030 if it continued in similar growth.

If progressives had their way, the electric grid would be modernized and there would be major investments in battery storage. These clean energy investments would replace the funding sent to the nuclear and fossil fuel industries.

Finally, "Our Revolution" would protect low income people in the name of climate justice with jobs and support in the transition to clean energy. Bernie Sanders advocates that the U.S. take bold action and lead by example on the world stage. In the words at the end of Sanders' book, "Democracy is not a spectator sport. The future is in your hands."

Roger Lohr of Lebanon, NH owns and edits XCSkiResorts.com and has published articles about sustainability, trails, and snow sports in regional and national media outlets.

This Is Not A Tragedy! – It's the First Act of a Comedy

Cont'd from p.1

Resources Defense Council, said Donald Trump's orders are "legally not all that relevant."

Another part of the problem with undoing the CPP is that it was too modest to begin with. This can be seen simply by looking at the states that have sued to stop it. In some cases, their goals were so easy, that they did not really need to try much to achieve them. Arkansas, for example, entered the suit, but is already ahead of schedule on reaching its CPP goal because inefficient coal-burning plants were replaced by much less expensive wind power.

Colorado has done even better. While its Attorney General joined the suit to stop the plan, the state went ahead on solar and wind power under the guidance of its governor, John Hickenlooper. Now he has announced that Colorado has already met the plan's goals.

Scientists are arguing that the CPP does not reduce carbon emissions quickly enough to address climate change. The Trump Administration could theoretically try to get the Supreme Court to reverse its position by arguing that carbon-driven climate change is not happening, but over the history of the Supreme Court, it has rarely revisited old cases. Furthermore, the administration would have to make their argument before justices whose background includes a time when Richard Nixon was president. Remember Richard Nixon? He was the conservative Republican who created the EPA.

The greatest problem with opposition to the plan can be revealed by examining Colorado's success. At the very time that carbon emissions make fossil fuels problematical, renewable power is making the economics of fossil fuels increasingly marginal, in the case of natural gas, and inexcusable, in the case of coal.

The economic forces against fossil fuels come from a "perfect storm" of factors favoring the competitive position of renewable power. The cost of onshore wind power has fallen well below that of combined cycle natural gas, the least expensive fossil fuel available. The cost of solar power is increasingly making it competitive not only with fossil fuels, but with onshore wind power. Offshore wind power has become less expensive than nuclear and has fallen below the cost of coal, on average. The job market for renewable power is the strongest in the nation, creating several jobs for every one lost by the fossil fuels industries.

The problem with intermittent power from solar and wind has become irrelevant, with a number of developments in the field of energy storage. The problem with intermittency becomes even more irrelevant with the introduction of virtual power plants, in which computers can match production precisely with demand, which coal and combined cycle natural gas cannot do.

Finally, the cost of failure to deal with climate change is becoming increasingly clear to just about every big business except a few in the fossil fuels industry. On the same day Trump signed his executive order trashing the CPP, Anheuser-Busch announced it would be powered 100% by renewable energy sources. And a long list of companies, state and city governments, and other organizations has since announced they would stay the course on climate change. Utilities will continue closing coal-burning power plants, and mines will continue to close.

This large mountaintop removal mine in Kentucky may soon be home to the state's largest solar farm. Photo: Berkeley Energy Group.

So ultimately, Trump and Pruitt cannot succeed in putting coal workers back in the mines. The market is not willing to buy expensive power or fuel when better cheap power is available. And whatever plan they put together will not keep natural gas or oil alive for the same reason, because the cost of solar and wind with battery backup has already become competitive with natural gas and is not subject to potential fuel shortages.

Astonishingly, part of this sad comedy is that the Trump Administration is attempting to eliminate economic programs designed to aid laid-off coal workers. This is in keeping with the heartless economics of what is euphemistically called a "free market." It is a market that does not have a capacity to put values on human life, human suffering, the environment, or even long-term planning for corporate sustainability, as it focuses narrowly on making sure that the people who finance it have good profits in the next quarter.

The coal miners will not go back to work. Instead, the Republicans they elected to Congress will need to explain to them not only what went wrong but why the federal government abandoned them. And to avoid taking the blame, they will put it on Donald Trump.

Tackling Transport this Spring

By Dr. Alan K. Betts

It has been a warm winter in New England. Burlington had no nights in January below 0 ºF, and the temperature reached a remarkable 70ºF on February 26th. The biggest snowstorm came in mid-March with two feet of snow in many places, but the snow quickly melted with sunny skies and the approach of the spring equinox. I picked spinach before the snow fell, and within four days the snow had melted off the cold-frame.

I am asked how soon we can plant! Frost-hardy plants can go in as soon as your soil has thawed, but don't plant anything that a frost will kill until the maples leaf out, unless you are prepared to cover them well. The clear nights of spring make frosts likely, because the earth can cool rapidly to space at night, until the deciduous forests leaf out and put more water vapor in the air.

Politically the last two months have had a certain fascination. After the inauguration, plans to develop the coal industry replaced dealing with climate change by phasing out fossil fuels. Meanwhile, the same week China canceled plans to build 100 new coal-fired power plants and replaced them with a plan to install 130 GW of new solar power by 2020. To give you a sense of scale, this is a thousand times the large build-out of solar power in New England in the last year or two. This illustrates in a nut-shell how climate change leadership shifted to China, while the U.S. stacked the new cabinet in Washington with fossil fuel advocates.

Our grandchildren will look back in horror and say "How could they sacrifice the Earth to protect the profits of the billionaires?" Well, our elected leaders pretend not to know that burning all our coal reserves will melt the icecaps, flood the coastal plains and wipe out half of life on earth. As Pope Francis pointed out in 2015, our use of power and our respect for creation is a deeply spiritual issue. We cannot serve both the Earth and money!

A typical automobile getting 25 miles per gallon and driven 12,000 miles per year burns 480 gallons of gas and emits 4.3 tons of CO2. A recent study showed that this melts an extra 140 ft2 of Arctic sea-ice every September.

Transportation in New England uses a lot of fossil fuel so it is one of the big challenges we face to "decarbonize" our economy. A typical automobile getting 25 miles per gallon and driven 12,000 miles per year burns 480 gallons of gas and emits 4.3 tons of CO2. A recent study showed that this melts an extra 140 sq.ft. of Arctic sea-ice every September. As the reflective sea ice shrinks, the warming of the Arctic accelerates, and we will soon face more amplifying factors like the release of methane, another stronger greenhouse gas.

I drive to meetings and to the grocery store, so how can I reduce the gasoline I use – only by shifting to electricity coming from solar power. For me this has taken a couple of years. First I invested in solar panels from a community array, providing 5.7 kW of peak power. Over the year, 80% of this power provides the electricity that powers our house and heats our hot water. The remaining 20% provides the power for a new Prius Prime plug-in hybrid, which we purchased last year.

Climate Forecast: "Above average temperatures are forecast for this spring."

The car's all-electric range is only about 25 miles, but that is enough to drive to my neighboring towns and back. The combination of an efficient hybrid car that gets 55 MPG and this modest all-electric range has surprised and delighted me. Even in the winter months, we have averaged 120 miles on a gallon of gas; which means we only fill up the 10 gallon gas tank every 1,200 miles. It is a far more efficient and comfortable car but using it will still emit almost a ton of CO2 every year, and inexorably contribute to melting some Arctic sea-ice.

The more general issue is that it is still a typical car for four passengers weighing over 3,000 pounds. Where I grew up in England, there were networks of public paths connecting towns that had been used for centuries – on foot or on horseback. For the future, New England needs a new network of small paved roads for lightweight electric cargo bicycles and tricycles. Even tricycles that are fully enclosed with a shell to keep out the weather are only a tenth of the weight of a standard car, so they are far easier and cheaper to power with solar electricity. But for safety reasons, they need a separate road network from heavy trucks and speeding cars. And yes, they will only go half the speed of cars - less than 30 mph. They could use heated seats in our winters, and there will be some snow-days.

But there are two fringe benefits that would benefit our health in the long term: some exercise commuting to work, and a closer connection to the landscape as we travel. This is of tremendous importance as our society must turn to the Earth for guidance.

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

Alan Betts in his all-electric car that is charged with the electricity from his own solar array. Courtesy photo.

Vermont Research Climate Change News

Climate Change Perceptions

By Kirsti Blow, Center for Research on Vermont

The threat of climate change has proven to be one of the nation's most momentous issues—just not in the concerns of the individual.

Tapped maple trees. Photo credit: https://botanistinthekitchen.wordpress.com

A majority of Americans believe in the existence of global warming, and as many as 69 percent of respondents across the country in a recent New York Times study expressed support for working toward imposing strict carbon dioxide emissions from existing coal-fueled power plants.

However, this figure shrinks dramatically when the question is reframed to ask if the respondents perceive that climate change will affect them individually. In Florida's Miami-Dade County, which borders the ocean, between 60 and 70 percent of respondents expressed little concern for their own well-being.

In Vermont, between just 30 and 50 percent (depending on the county) of those surveyed believed that there would be an impact on their lives.

Though Vermont boasted one of the highest propensities for maintaining a dialogue about climate change and its effects, this threat-perception is dramatically lower than it should be when the state's ski and sugaring industries are considered.

According to a 2014 report of projected climate change in the Lake Champlain Basin, daily temperatures are likely to increase by between 0.43 and 0.49 degrees Celsius (between 32.77 and 32.88 degrees Fahrenheit) per decade in the twenty-first century.

This spike in temperature poses significant consequences for a number of Vermont's largest industries, including dairy farming, maple syrup production and ski resorts.

In fact, snowfall at six major ski resorts in the Lake Champlain Basin region is expected to decrease between 46.9 percent and 52.4 percent by the late twenty-first century. This will no doubt cause a reduction in recreational tourism, a valuable source of state income—and less snowy days for the state's avid skiers and riders.

The maple syrup industry is no less of an economic driver, with a 131 percent growth in production between 1992 and 2014 in the U.S. In 2013, maple production yielded between $317 million and $330 million.

Sugar maples, however, require highly specific weather conditions in order to exude sap suitable for maple syrup production. With the rising temperatures and unpredictable weather events of a changing climate, the number of suitable days for production is projected to decrease.

Along with this time crunch, the annual peak production times in autumn and spring are likely to shift into midwinter. By mid- and late-century, the number of production days are projected to be reduced from 60.3 days in 2013 to 53 and 49, respectively.

As for dairy farms, rising temperatures and changing weather patterns are expected to affect agricultural productivity across the country, particularly in the Midwest. The corn, soybean and wheat supplies characteristic of that region are projected to decrease—likely hiking the cost and availability of animal feed in Vermont, and hindering dairy farms' abilities to feed their livestock.

On paper, Vermont may seem to be a state with limited threats stemming from climate change—the northeast snow and land-locked mountains appear unlikely to be swept up by apocalyptic flooding. But the climbing temperatures and irregular weather patterns pose a real threat to the state's most identifiable industries, and succeeding generations will undoubtedly feel the environmental constraints.

Kirsti Blow is a sophomore public communication major at University of Vermont. She writes the briefs for UVM's Vermont research newsletter published by the Center for Research on Vermont. Learn more at http://www.uvm.edu/~crvt/. Kirsti is also a local musician in the Burlington area.

HalfMoon Construction Wins International Award

- Takes Best in Show for Large Residential Project

By George Harvey

Insulating Concrete Forms (ICF) have been around for about 75 years, and originally had appeal as an inexpensive material for making building repairs. With the advent of new polymers, however, there was increased interest in ICFs as a building material, and they became more commonly used. With a growing focus on building efficiency in the past few years, ICFs may have come into their own.

The advantage ICFs have is a combination of excellent thermal qualities and a potential for nearly perfect air sealing. These qualities make them especially well-suited to highly efficient home construction.

Andy Ellis receives ICF Builder Award for Best in Show in the Large Residential division at the World of Concrete Trade Show in Las Vegas on January 19, 2017. Photo courtesy Peter Ellis.

Unsurprisingly, companies focusing on ICFs have formed a professional association, the ICF Builders Group. Their annual trade show attracts hundreds of participants, who include builders, architects, and manufacturers. One thing they do each year is to give awards for the best buildings by class.

At the World of Concrete Trade Show in Las Vegas on January 19, 2017, the ICF Builders Group's award for Best in Show in the large residential division was given for the Shelving Rock Home in Glenville, New York. The winning home was built by Halfmoon Construction Company (HCC), of Clifton Park, New York, whose name many readers of Green Energy Times might recognize.

The award was given to the Shelving Rock Home partly because of the fact that it showcases the advantages of building with ICFs. These include the home's remarkable energy efficiency, durability, and noise-free interior space. The home's fast construction time and low insurance rates of ICFs were also mentioned.

Quality and demonstration of innovation were important considerations as the award panel considered applicants. Clark Ricks, executive director of ICF Builder Group and organizer of the competition, pointed out, "The variety and scale of projects being built with ICFs is truly astounding. It's time these outstanding projects received recognition, and we feel privileged to take a leading role in that. These projects truly represent the best of the best."

HCC was founded in 1999 by Andy Ellis. It focuses on custom design and construction of home projects that work within sustainable buildings and energy standards. Ellis prides himself on attention to the customers' needs and HCC's innovative problem-solving techniques, which have not only been the basis of both solutions, but also of lifelong relationships.

Ellis readily shares the praise he has earned with those who work with him. He said, "I'm very proud to be part of the ICF building community and of the homes we build with Logix-ICF. With the hard work of my team and vendors, we are building a home that will last for many generations to come. To us, there is nothing better than sharing our mission; building ICF homes, educating the community about the benefits of using ICF, and showing off the end result, a great looking home. Building with ICFs has many rewards for the builder and clients alike, such as long term energy savings, quiet homes, disaster resilience and sustainability."

Doug Ford, VP Sales and Purchasing at Curtis Lumber, one of Ellis' suppliers, said, "I have had the pleasure of knowing Andy Ellis since he began his construction business in 1999. In my role with a major building material supplier, I get to work with many builders. Andy Ellis stands out as a quality builder, who cares about producing a quality product and at the same time creating a great experience for his customers. Andy is committed to staying current with all of the industry's rapid changing technology and code requirements. Andy has differentiated himself as the local "go-to" guy for energy efficient, high performing, sustainable homes. The award winning Shelving Rock Home in Glenville, NY is an excellent example of the craftsmanship and technology you can expect from Halfmoon Construction Company."

Win Peck Jr., Regional Sales Manager for Logix-ICF, added, "When Halfmoon Construction's Shelving Rock project was submitted for the large residential category for the ICF Awards, I knew it would do well. Mr. Ellis' attention to detail and determination got first place; amazing for a first time entry in any category. Large residential is the premiere category and best in show is certainly a testament to excellence. Anyone building a green, net-zero, generational, residential or commercial project can rest assured that Halfmoon Construction will perform at the highest level."

Halfmoon Construction's web site is halfmoonconstruction.net.

Green Energy Times offers our best wishes and congratulations to Andy Ellis and all whose efforts were involved in the building of the Shelving Rock Home.

Shelving Rock Home complete. All photos courtesy of Halfmoon Construction.

Construction with ICFs.

Shelving Rock's kitchen.

RETROFITS VS. REDUCTIONS

By Marc Rosenbaum

I'm excited because I've been putting together a new online course on Deep Energy Retrofits (DER). More so than the course I teach on Zero Net Energy Homes, it's focused on the multiple approaches and techniques for taking the diverse building stock we have and transforming it – not just from the standpoint of energy use, but also upgrading comfort, health and safety, and durability – because so much of our building stock is plagued with deficiencies. Retrofits fix the issues with the building asset and saving energy almost ends up as a desirable byproduct. There are so many different buildings and conditions, and therefore solutions, so the DER course is based on case studies and we show many approaches people have chosen to implement.

R-60 insulation for the standing seam roof. Photos: Janice and Steve Kurkoski

If energy saving is the principal goal, it's important to look carefully at the choices the occupants make. Energy in buildings goes to more than heating and cooling, which are the main loads that retrofits target. Over forty percent of primary energy in US homes goes to non-thermal loads. Once we super-insulate a house in New England, energy for heating, once the largest load by a comfortable margin, may become the smallest load amongst heating, domestic hot water (DHW), and plug loads/lighting/appliance loads (PLA). To get to truly low energy performance then requires focus on DHW and PLA.

With motivated occupants, it's possible to get deep energy reductions without DERs. People can do a moderate weatherization on a house, then install a point source heater such as a single zone mini-split heat pump to keep the most-used part of the house comfortable. The rest of the house runs cooler and the main heating system stays off until the outdoor conditions get severe. Lots of savings have been demonstrated in this approach. Couple that with LED lighting replacement in high use fixtures; great low flow showerheads like the Delta H2OKinetic; a horizontal axis washer; and depending on the household size, perhaps a heat pump water heater. Replace the dryer with a drying rack and a clothesline. Make a concerted attempt to keep appliances and entertainment stuff off when not using it. Hunt down phantom loads.

Combine all of the above and the total outlay might be $10-20,000 and the energy saved might equal or even exceed what a second household might achieve that goes the whole enchilada and does a DER, if that second household is much less conscious of their DHW and PLA usage, and heats the whole retrofitted house to comfort temperatures. I definitely see DER households using a pretty wide range of energy per person. The climate doesn't care how we each reduce our consumption, just that we do. Of course a motivated, conserving household in a DER will have the lowest energy usage of all, but if a household is committed to reducing their carbon emissions, they needn't spend six figures to get there. What the DER gets that the targeted weatherization, behavior-based deep energy reduction strategy may not is relief from the non-energy deficiencies – ice dams, pest infestations, water issues, mold, etc., and true comfort. The cost of remediating those defects shouldn't have to be paid for solely by the energy savings that accrue.

I live in a zero net energy DER after previously weatherizing a pretty good house and also reaching zero net energy. I like the second house a lot better, because of its superior comfort and air quality. But I spent a lot more money to get there, and the total energy performance isn't much better, because DHW and PLA usage is pretty similar. The DER uses less energy for heating at an even 70F setpoint than the pretty good house used with some temperature setback and letting parts of the house get cooler. I hope to live in this retrofitted house for a long time, and it's worth it to me to have spent what I did to get a house my wife and I are so pleased to inhabit. I'm just not fooling myself that I needed a DER to achieve deep energy reductions, if that was my only goal.

To learn more about the transformative possibilities of Deep Energy retrofits, please check it out at http://bit.ly/DER-course. Read more from Marc's blog at http://thrivingonlowcarbon.typepad.com/ or at South Mountain Company's website is www.southmountain.com.

Janice and Steve Kurkoski doing some high performance improvements to their home.

Can a Passive House be Beautiful, Functional, and "Organic"?

An Interview with Hank Keating -- Stone Fruit Farm

By Barbara Whitchurch

Stone Fruit Farm, completed in 2016, is a complex of buildings in the small town of Westport, Massachusetts, built to the Passive House (PH) standard. It calls to mind the design of the classic New England connected farmhouse (main house, connected to outbuildings, plus a barn). The main house includes a master bedroom with a study and a two-bedroom guest area. Because it was designed to serve as an organic farming operation, it also includes a one-bedroom apartment for a farm intern. In addition, there are six totally passive (no heating or cooling) outbuildings, including garage, workshop, barn, greenhouse, root cellar and their connecting corridor. Solar domestic hot water and a 7.6 kW photovoltaic array were sized to be net-positive for the habitable structures.

Green Energy Times was fortunate to be able to interview the owner-architect, Hank Keating, to get a sense of the development of this project. Hank recently retired from his position with a large development company, but continues to consult on large-scale affordable housing projects including a 28 story passive house high-rise in New York City.

GET: Tell me about the history of this project.

Keating: Over the last many years, my wife and I had a vision of creating an experimental organic farm. We were living in Boston when we bought the land 10 years ago and started designing the house. My wife runs it as an "incubator farm" where people can test their ideas. We now rent the apartment to a young couple that includes access to the land, the equipment and the apartment in exchange for labor on the property. I hired Mike Katon of the Valle Group to manage the construction, but I remained very involved in the project.

GET: What about the unusual configuration of the buildings?

Keating: An unconditioned passive corridor connects all of the outbuildings and the guest area of the main house. Temperatures on sunny days range from 25 to 125 degrees. We used concrete blocks with dark aggregate, which absorb heat during the day and radiate it into the outbuildings at night. Insulation between buildings prevents loss of heat to the outside. We run our clothesline down the corridor to dry our laundry.

GET: Can you give us some of the numbers for the techies among us?

Keating: Sure. Passive House is currently the highest energy performance/comfort/health standard of construction. While there are energy modeling tools that can be used for any kind of building, a Passive House building has special tools designed just for it (PHPP and WUFI Passive). The certified PHPP modeler for this project was Mike Duclos, whom I had the good fortune to meet at a Passive House conference.

The building's estimated primary energy demand (energy per square meter) is 105 kWh/m2/yr. Blower door: .46ACH50. Total net positive to date: 3471 kWh (as of Dec. 2016). Insulation: loose fiberglass, dense-packed; R-value in walls R71; roof R100. Windows: Tilt-turn Yaro triple-pane, with U-value of U.15 and SHGC U.62.

The house uses Mitsubishi air-source heat pump mini-splits and a Novus 300 HRV from Zehnder for heating/ventilation. In addition, there are two ethanol alcohol fireplaces. They aren't ducted, but the HRV in "boost" mode compensates for any oxygen burned and CO2 discharged.

GET: Any tips for future builders or designers?

Keating: I'd recommend that all builders take the Passive House Builder's Training. And the full team, including primary subs, architect, and PH consultant, should have regular meetings focusing only on PH issues. It's crucial for everyone to work together in a coordinated way when building a high performance home, because attention to detail is critically important.

GET: How do you like living in a Passive House?

Keating: We love it! Its most unique feature is that all rooms have southern exposure. I call it a "single story candy bar," 19 feet wide by 85 feet long. Every space gets direct sunlight and direct heating from the sun. The comfort level is fantastic. We have never actually turned the heat on! One night, a year ago, it was six below, the inside temp went down to 61. When the sun came out, it was back to 72. Because there are no drafts, we find temperatures of mid-60's to mid-70's totally comfortable. My wife, who is a gardener-farmer who always wants to be out in the dirt, says she feels "like I'm outside already" because of the views and sunlight from the large southern windows.

Stone Fruit Farm is featured in Green Builder Magazine (http://bit.ly/GBM-Stone-Fruit-Farm) and in Passive House Buildings: New England Forges Ahead (http://bit.ly/PHB-Stone-Fruit-Farm).

Barbara Whitchurch is a Board Member of Vermont Passive House. (phausvt.org). She is the co-owner of a certified passive house in Middlesex, Vermont, and is a freelance editor, writer and jewelry artisan ,and the pet parent of the world's greatest Great Pyrenees, Bailey.

Left: Stone Fruit Farm in Westport, MA. Above: the living room; below: interior view of solar corridor. Photos: Jon Moore Photography.

Many thanks to our Sponsors.

Free At Last Cont'd from p.23

the walls that had insulation, and a blower door number of 1841 CFM50. The basement flooded in the spring with high water marks on the interior surfaces of the foundation walls about a foot above the slab. The oil-fired boiler (which provided heat through radiators and domestic hot water) consumed 715 gallons of fuel, and the wood stove went through a cord and a half that year.

I've been working on the house in stages (as time and money allow) and since then, I have air- sealed the attic and put in 24 inches of cellulose (R-80); insulated three of the four walls to R-44 (I still need to do one of the gable ends, which I'll do when I replace the windows this summer); insulated the basement slab to R-15 and the basement walls to R-44 and put weather stripping on the original windows and doors. The blower door number is now at 1040 CFM50. Perimeter drains now keep the water out of the basement. I stopped using the boiler and radiators to heat the house the winter I moved in and have relied solely on the wood stove. Each phase of air-sealing and insulating has resulted in less wood use (now down to 1.5 cords from a high of four), and this winter I decided that it was time to get rid of the boiler, oil tank, and indirect hot water heater that were taking up a lot of otherwise perfectly good space in my basement. I installed a heat exchange hot water heater, and my cost for heating domestic hot water has been reduced from about $400 per year to about $80.

My hope was to install interior storm windows to save the cost of replacing the original single pane units, but the cost of high performance windows has come down enough and their performance has gone up enough to make it worth it to me to swap them out this summer. I really debated this for a long time (seven years in fact), but the originals have been exposed to the elements for a long time, and they need a lot of repair work.

Once the windows are replaced, I will definitely need to install a heat recovery ventilator, since I won't be able to "rely" on the leaky windows for indoor air quality. That will happen in the fall, before I have to close the windows for the winter. At some point, I will install an air-to-air heat exchange heating unit or an air-to-water unit with a small low temperature radiator panel on the main level and in the basement.

One of the things I have noticed about living in a high performance home (it will be higher after the windows and HRV are installed) is that I don't think about outside temperature the way I used to. The house is comfortable all year. On sunny winter days, I often don't need to run the stove during the day thanks to good siting and south-facing windows. On cloudy spring and fall days, I only need to run it for a few hours in the evening and the house is still very comfortable (bare feet and t-shirt kind of comfortable) when we get up in the morning. In the summer, the large eaves prevent the sun from overheating the house and cross ventilation takes care of the rest.

Michael Goetinck is the owner of Snowdog Construction, Ltd., in Norwich, VT. You can reach him at 802.649.3605 or michael@snowdogvermont.com.

Sustainable UV Cont'd from p.21

year. (bit.ly/GET-McKnight-Lane). Another example is Maple Street condos in Hartford, VT. It features environmentally sustainable bamboo flooring. All glues, foams, and materials are made with low or no VOCs. It has sustainable metal siding. Locally-sourced products are used for construction as often as possible, supporting our environment and local economy.

Each unit has a 7 kW solar system to produce all of its energy, so the units are projected to have no electric or heating costs. The appliances are all Energy Star rated; CERV Energy Recovery Ventilator units monitor air quality (CO2 & VOC's) and regulate air flow and temperature in the units; and all have electric HVAC systems that incorporate efficient heat-pump technology, requiring very little electricity to operate.

Weatherization in the Upper Valley

Vital Communities launched the Weatherize Upper Valley campaign this January with an ambitious goal: double the number of homes weatherized in the Upper Valley over the next two years. As of press time, there are more than 300 people involved in the program from 14 Vermont towns. More than two dozen contracts have been signed with the Weatherize Partner Contractors, and scores of volunteers work with new participants each day to move them toward a more comfortable, efficient home.

Most home weatherization projects focus on air-sealing and insulation, two cost-effective ways to increase comfort and reduce energy costs.

Cont'd on p.33

New Hampshire Legislative Updates

By Michelle Harrison

The spring has been very busy in the legislative and regulatory offices. As part of the New Hampshire Public Utility Commission's (PUC) process to determine the state's future around net- metered renewable energy across the Granite State, the Energy Future Coalition submitted a settlement proposal with the goal of achieving a compromise using a proven, data-driven approach to lower energy costs for consumers, continued economic growth and job creation for the state, and the opportunity to position New Hampshire as a leader for clean energy.

The Energy Future Coalition is an alliance of local and national solar businesses, energy industry representatives, and clean energy advocates, including the NH Sustainable Energy Association (NHSEA) seeking to find a data-driven, New Hampshire-specific solution that includes compromising on the value of distribution credits paid for exports and obtaining a NH-specific Value of DER study. New Hampshire policymakers demonstrated tremendous leadership last year by signing HB 116 into law and doubling the state's solar net-metering cap. Net-metering is a policy that enables the right to self-generation and fair credit for power sent back to the electricity grid. The bill also initiated the state's PUC to launch a 10-month proceeding to explore the future of net metering policy in New Hampshire. As the PUC nears a decision, this coalition's proposed compromise offers a path forward for the state to begin driving down energy costs for consumers and making the state more energy-independent, while protecting ratepayers, supporting thousands of good jobs, and continuing to grow the renewable energy economy. The PUC hearing on the two competing net-metering settlements closed on March 30, 2017. A decision is expected by June of this year.

After the spring break, many bills crossed over from one body of the Legislature to the other, as follows:

SB128: An act relative to the policy goal of electric utility restructuring. This bill would give utilities broad authority to undertake large infrastructure projects and enter into long-term power purchase agreements. It undoes some of NH's present Electric Restructuring policy.

SB123: Establishing a commission to study a carbon reduction investment program for NH. NHSEA supports this bill

SB124: Establishing a commission to study municipal regulation and incentives for solar energy. NHSEA supports this bill. This bill passed in the Senate and is now in the House.

SB51: Establishes a study committee to review "RPS (Renewable Portfolio Standards) subsidies." It passed in the Senate, and is now in the House.

HB1 & HB2 (budget bills): HB2 would divert 20% of the Renewable Energy Fund each year. HB also has problematic language that could prevent the PUC from expending funds to implement the EERS. NHSEA opposes both of these items in the budget.

New Hampshire Statehouse. Photo: Wikimedia Commons.

HB574: An act increasing the limit on contributions to the community development finance authority for which an investment tax credit may be taken. NHSEA supports this bill.

SB 129: An act improving the RPS by increasing the solar resource class, directing a portion of the Renewable Energy Fund to low-income customers, and improving the biomass provisions. NHSEA supports this bill, which passed the Senate and had a hearing in the House on April 11.

Tax Reform and Climate Action

Cont'd from p.3

focused squarely on tax reform. The proposals aim to replace taxes on things Vermont wants to foster, like income, sales and property, with a fee on something the state wants to reduce – the carbon pollution contributing to climate change.

Rep. Gonzalez' bill is a bit different. Her proposal is modeled after the recent call by prominent Republican leaders who are pushing for a carbon fee and dividend to reduce carbon emissions. Rep. Gonzales' bill, H.531, would set a fee on carbon pollution starting at $10 per ton and rise each year until it equals the "Social Cost of Carbon" as calculated by the Environmental Protection Agency (EPA). The collected revenue would be returned to every Vermonter and Vermont business in equal dividend amounts on a quarterly basis, either in the form of checks or direct deposits.

"Climate action is good for Vermont's economy," said Rep. Sarah Copeland-Hanzas, lead sponsor of a bill to eliminate the sales tax. "President Trump wants more coal, but we don't have any coal jobs in Vermont. What we do have is over 17,000 Vermonters working in clean energy. And cleaner, high-tech heating and transportation can mean more money in Vermonters' pockets."

Clean energy is now the fastest growing sector of Vermont's economy. Policies like carbon pricing could further accelerate job growth in this sector and more broadly stimulate the state's economy by keeping more of the $2 billion Vermonters spend every year on imported fossil fuels in the state. That means more money in people's pockets and more motivation to reduce reliance on fossil fuels. It also means putting Vermonters to work weatherizing homes, installing solar, transitioning them to heat pumps or pellet stoves for home heating needs and more.

Beyond the clean energy industry, a growing number of Vermont business leaders are voicing support for a carbon fee coupled with progressive tax reform.

"My business -- The Alchemist -- nearly got wiped off the map by Irene six years ago," said Jen Kimmich, owner of the Alchemist brewery. "Global warming and its dangerous consequences are real. We have a responsibility to do all we can to tackle it."

Rep. Sarah Copeland Hanzas announces the new tax reform proposal with a fee on carbon pollution to a group in Bradford, Vermont. Courtesy photo.

Iconic ice cream brand Ben & Jerry's hosted the press conference announcing Rep. LaLonde's property tax relief proposal. "The evidence for climate change cannot be any more clear. 2016 was the warmest year on record and it was the third consecutive year in which a record was set worldwide for average surface temperatures," Ben & Jerry's co-founder Jerry Greenfield remarked at the event. "We all have a duty and responsibility to not only make a stronger economy, to not only have a more sustainable world, but by doing it by having a tax system that is more fair and more just."

In addition to encouraging long-term sustainability and economic growth, the new tax reform and climate action proposals are aimed at protecting and assisting low-income Vermonters.

"The energy burden placed on low-income Vermonters from a carbon-based economy has a significant impact on their financial stability," explained Dan Hoxworth of Capstone Community Action. "To reduce the risk to, and the impact on, low-income Vermonters, we need to accelerate the transformation of our economy towards renewable [energy] and away from carbon-based fuels." He emphasized that carbon pollution fee proposals like the one sponsored by Rep. Donovan align with the goal of working towards a healthier, more equitable and affordable state.

These proposals also speak to the obligation to leave a sustainable legacy for current children and future generations. Scientists have warned that doing nothing to reduce carbon pollution will result in widespread climatic calamity, likely within the lifetime of today's youth. This message of the risk climate change poses to younger generations was brought directly to the State House by nearly 1,500 Vermont students who rallied for climate action on April 12th, just two days after the roll out of the four carbon pricing proposals. These students voiced strong support for the new bills, adding a sense of urgency to the legislative effort to address carbon pollution.

The four bills are now in House committees. With the current legislative session set to wrap up soon, it is not expected that the bills will move forward at this time. Instead, the lead sponsors are hoping to generate robust conversation around the need for broad tax reform coupled with climate action, leading to more detailed legislation and deeper consideration in next year's session.

Other states in the region are also looking into a carbon tax. Massachusetts is leading the charge with two bills that have garnered 79 total co-sponsors. New York, Connecticut, and Rhode Island each have pending carbon tax bills as well. New Hampshire also has a bill calling for a carbon tax study.

Taken together, these initiatives underscore the importance of states stepping up to lead in the face of federal government hostility towards climate action.

"Donald Trump's policies will only accelerate climate change and endanger the jobs and health of thousands of Vermonters. That's why it's so important that we fight back against the economic and environmental damage his policies will cause," write Reps. Copeland-Hanzas, LaLonde, Gonzales, and Donovan in a joint op-ed piece. "Tax reform and climate action may be Vermont's most effective response."

Dana Drugmand is a student at the Vermont Law School in their Master's in Environmental Law & Policy, as well as an intern at the Vermont Natural Resources Council (VNRC). VNRC is an active partner in the Energy Independent Vermont coalition. Learn more at www.energyindependentvt.org or contact Dana at ddrugmand@vnrc.org.

Colby-Sawyer College Students Partner with PermaCityLife

To Support Franklin's Revitalization Efforts

by Jennifer White

The ongoing collaboration between Colby-Sawyer College and the City of Franklin, New Hampshire continues to blossom and bear fruit. During the 2016 - 2017 school year, one hundred and fifty students participated in revitalization efforts spearheaded by a group of dedicated community members including Todd Workman, executive director of the nonprofit PermaCityLife. The students are participants in an innovative new curricular program at the college called the Sustainable Learning Initiative at Franklin Falls (SLI), which pairs the learning outcomes in majors across campus with the to-do lists of the revitalization project partners.

Executive Director of PermaCityLife Todd Workman, during field studies for the Sustainable Learning Initiative. Photos by Chris Kontoes.

PermaCityLife is dedicated to highlighting the rich history and stunning architecture of the community while using innovative techniques that maximize the city's resilience and sustainability. Like many cities across the country, Franklin was once a booming mill town with thriving businesses and social activities; when those industries left, it failed to find what community branding expert Roger Brooks calls its "second act." Franklin has significant social and economic challenges which are balanced by a host of strengths that include a walkable downtown at the confluence of three rivers, stunning architecture, recreational opportunities, and a passionate and determined citizenship.

SLI is an experiential learning opportunity for students to explore, design and develop sustainable solutions to real and evolving community needs. To complement the SLI, Colby-Sawyer launched an innovative three-year degree in sustainability studies in September 2016 that allows students to save approximately 20% on the cost of their college education and gain professional hands-on experience while still in school. In November, Colby-Sawyer and PermaCityLife also celebrated the grand opening of a shared field studies office in downtown Franklin.

The remodeled storefront serves as the hub for partnerships and projects within the downtown, functioning as the main office for PermaCityLife and home base for Colby-Sawyer classes and interns working with project partners. CATCH Neighborhood Housing (a housing non-profit based in Concord), which recently began work on quality affordable housing in the former Light and Power Company mill, will also use the space.

Last semester, graphic design and exercise and sport sciences students collaborated on a comprehensive branding strategy and business plan for Mill City Park's biking and whitewater project, and ecology students analyzed aquatic life to assess water quality prior to the in-river modification and park restoration. The sustainable food systems class developed a community garden design and the social entrepreneurship club wrote a business plan for the Twin Rivers Interfaith Food Pantry. This spring students inventoried riparian invasive species, conducted sociological interviews related to quality of life in post-mill towns, offered web design input for Take Root Coworking, and evaluated the embodied energy and bioremediation options for the Amory and Stanley Mill buildings.

PermaCityLife, in association with the City of Franklin and other dedicated residential and commercial partners, has helped launch eight new businesses including a volunteer run coffee shop with New Hampshire made products, a co-working space, an outdoor outfitters store and a community-based counseling center. And, as Colby-Sawyer students lend their time to help these new entities succeed, they gain invaluable skills while also helping this remarkable community continue to grow and flourish. Learn more at: www.sli-franklinfalls.com and www.permacitylife.com.

Jennifer White is the Director of Sustainability and Assistant Professor of Environmental Studies at Colby-Sawyer College and Sustainable Learning Initiative Program Coordinator.

Rayla Putnam '18, Nat Mengesha '17 and Amber Sweeney '17 perform water quality analyses in the Winnipesaukee, Pemigewasset and Merrimack Rivers for their community partner Mill City Park, as part of Professor Nick Baer's Aquatic Ecology class at Colby-Sawyer College.

Why We Need Wind Power in Vermont and in the Northeast

Cont'd from p.15

Georgia Mountain Community Wind Farm. Photo by Katherine Norris.

is fundamentally changed into something we do not want.

In order to deal with climate change, we will have to eliminate our use of fossil fuels. This includes those used for heat and for transportation. Fortunately, we can do those things without giving up comfort while reducing costs. But it means that we will have to use about three times as much electricity as we do now.

We have choices for where we get renewable power. We can generate it locally, or we can bring it in from outside. If we take the position that we do not want to use large-scale solar or wind projects, then we will not be able to get even a third of the power we need from nearby.

People who do not want to get our power from large-scale solar or wind because of the environmental damage they suppose these would cause, or because of the appearance of solar and wind farms, miss a fundamental point. It is that the only alternative we have for getting three times as much power is to increase greatly the numbers of transmission lines that we have. This would be far worse than wind farms both environmentally and esthetically.

They also miss the point that by generating as much of our power as possible within the state, we will be keeping the money we spend on electricity within the state.

It is very important, in order to move to robust and healthy renewable energy, that we have a diverse set of energy sources. These include both wind power and utility scale solar power, but also include rooftop solar, hydro power (for which we do not necessarily need new dams), bio-digesters, clean biomass waste burning, and different kinds of energy storage. We also need "smart grid" technologies with grid response in what are called "virtual power plants."

Among all of these technologies, the least expensive happens to be wind power. Wind power also uses very little land compared to solar power and hydro dams. Studies show that many more tourists are attracted to views of wind turbines than are repelled by them. Many people who live very near wind farms, and in fact thousands of people who live inside wind farms across this country, not only do not object but like them.

Wind power and solar power share one big fault, which is certainly a bone of contention and a source of some of the opposition to them. They represent an existential threat to the fossil fuels industries. They threaten to eliminate industries that make us sick, shorten our lives, and are ruining the environment. But politicians whose campaigns are paid for by the fossil fuels industry, and advocates of those industries, are willing to push hard to prevent wind power from being used widely in our state.

The combination of wind power, large-scale solar power, and battery storage, is now competitive with natural gas, the cheapest fossil fuel. All fossil fuels cause climate change, which threatens destruction of species of animals and plants. We should put the focus of our objections where it belongs.

Natural Gas Utilities and Geothermal Heat

By George Harvey

In January, Renewable Energy World published an article by geothermal expert Jay Egg, Can Natural Gas Giants Switch to Geothermal? (http://bit.ly/NG-to-geothermal) In it, Egg makes a good case that geothermal heating may be an excellent path to continued profitability for natural gas (NG) utilities.

Geothermal heating has considerable economic advantages over NG. Geothermal heat is as carbon-free as the electricity that powers it, which it uses very efficiently. Its ongoing costs are low and much more stable than those of fossil fuels. And, it can run on renewably generated electricity.

We should describe how geothermal heating works for those who do not know. It is available nearly anywhere the sun warms the soil. The temperatures a few feet underground are fairly stable. We can get water to that same temperature by running it through a loop of buried pipe and then use it to heat or cool a house. The water can then be returned to the loop for reuse.

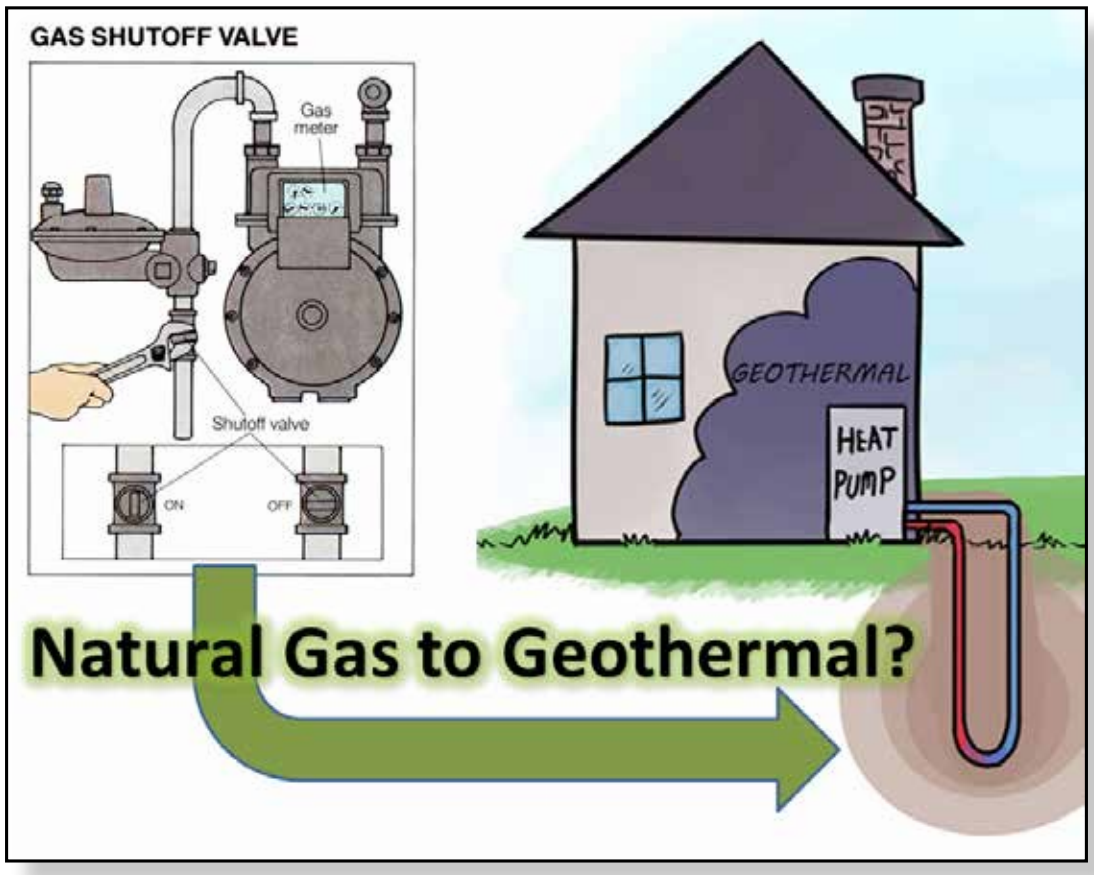


Photo courtesy of EggGeothermal.

Because geothermal systems move heat, instead of creating it, they can be very efficient, both for energy and for cost. The U.S. Department of Energy rates it as our most efficient heating technology.

Environmentally, geothermal heat pumps are superior to fossil fuels in every respect. Geothermal heat is very quiet and comfortable. It does not need to consume water. Geothermal equipment is long-lasting. No equipment is exposed to the elements, so the system is not likely to be damaged by weather. Geothermal heat can be a key part of a system for complete energy self-sufficiency.

Some people feel that the initial cost of geothermal is too high. Many of them think the same of photovoltaics and wind power. Such thinking is badly outdated. The cost of installing a geothermal heating system might actually turn out not to be any higher than that of installing a complete new oil-burning heating system. Oil heat requires a tank, which is usually contained in the building or might have to be buried. A new natural gas system can cost even more, as pipeline connections can be expensive.

For many potential customers, natural gas is not even available, because there is no pipeline in their region at all, or perhaps not in the street they live on. The geothermal system, by comparison, really only requires that a building has electricity and sits on the ground.

Geothermal could be a problem for a NG utility, because customers may be quite capable of defecting to it for heat. Even if the utility sells both, the customer who moves from NG to less expensive geothermal heat will cost the utility revenues.

Fortunately for NG utilities, they can actually take advantage of the geothermal systems initial cost. Though anyone who can afford heat could afford to pay off the financing of a geothermal system, some balk at the idea of spending $10,000 or $15,000 on geothermal piping. This gives a utility a possible new service, providing geothermal systems under contract.

For NG utilities, expanding into geothermal heating can bring customers who have no access to gas pipelines. It would be hard to overstate the importance of this.

We contacted Jay Egg to see what the latest developments were. He replied with these notes:

"In 2016, Ontario released their Climate Change Action Plan (CCAP), which calls for sweeping reductions in GHG emissions, specifically calling out NG, and actually outlaws combustion heating in residential and light commercial buildings by 2030. That's only 13 years.

"Because of the great work and powerful influence of Martin Luymes in his positions as Director of Programs and Relations at the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI), the 'Geofication Committee' was formed, which consisted of David Hatherton, Dr. Stan Reitsma (a prominent geothermal expert), and Jay Shepherd (legal counsel). Over the last year or so, these folks have worked tirelessly to properly represent the geothermal industry story to Ontario. Their success may be evident in the new direction that a major gas utility, Enbridge Energy has taken toward geothermal utility development. Enbridge played a large role in the recent OGA Conference.

"The Geofication Committee was the key in illustrating to legislators the cost of further subsidizing pipelines for 68 additional communities came at the hefty price tag of C$25,600 for each NG connection on average. The effects of these efforts in Ontario and their neighbor to the South, New York can't be overstated. This is the type of efforts that often lead the way for programs that gain national acceptance.

"Bill Nowak, NY-GEO's Executive Director attended the OGA event and was given the opportunity to say a few words. NY –GEO's Conference is coming up on April 19-20, 2017. This event promises great progress for the industry, similar to OGA's great efforts."

SUSTAINABLE UV

Cont'd from p.29

According to Efficiency Vermont, the average cost of weatherization improvements in communities in Vermont in the UV region is $7,800 (before rebates, averaging $1,500), and they result in increased comfort and 26% average energy savings.

Towns participating in round one of Weatherize Upper Valley include the **Randolph Team (Brookfield, Braintree, Randolph); White River Team (Bethel, Royalton, Sharon); Connecticut River Team (Thetford, Norwich, Hartford, Hartland); and Ascutney Team (Reading, Windsor, Cavendish, Weathersfield)**.

Learn more and sign up for round two at VitalCommunities.org/Weatherize.

Weatherization Agencies under Community Action Programs

The agencies offer assistance in evaluating buildings' (single-family and multi-family) energy performance, perform energy audits, including review of building 'shells' and mechanical systems. Free services are offered to income-eligible homeowners, and multi-family buildings and projects where residents are certified as eligible. Some of the agencies perform work doing the same services for non-income-eligible projects and owners, as for income-qualified participants.

Three key agencies working in the Upper Valley are as follows.

Southeastern Vermont Community Action (SEVCA) based in Westminster, VT and covers all of Windham and Windsor Counties in Vermont, going from the Mass. line, north through Norwich, VT.

Capstone Community Action based in Barre, VT covers all of Orange County from Thetford, VT on north and westward, as well as other regions in more central Vermont.

Tri-County CAP, based in Berlin, NH covers all of Grafton County in NH, as well as Carrol and Coos Counties -- a very large area, all of northern New Hampshire.

While the Weatherization programs' bases of operation may not be in the core 'UV' the agencies are geared to cover the many needs of a large region.

HEATING EFFICIENCY

Froling from Peterborough, NH

Froling specializes in biomass boiler systems. Its project installations in the UV result in a total of 250,000 gallons of oil offset by wood pellets and PDCs (precision dry chips).

Froling's projects can be seen in Sharon, VT, at the Orange Windsor Supervisory Union; Canaan, NH, at the elementary school; Charlestown, NH, at its elementary school; Charlestown, NH, at Whelen Engineering (see GET article at bit.ly/whelen_froling); Claremont, NH, at the middle school; Claremont at Stevens High School; Cornish, NH, at the elementary school; Enfield, NH, at its elementary school; Enfield at the Indian River Middle School; Enfield at the Mascoma Valley Regional High School; Lebanon, NH, at Sacred Heart Parish; and Lyme, NH, in the elementary school. In Walpole, NH, the elementary school installed two Froling boilers in 2015; its gross output is 684,000 Btu/h, and it has offset 8,000 gallons of oil.

TARM Biomass - Orford, NH

Tarm Biomass® is a third-generation, family-owned business that has pioneered the sales and service of European residential central heating equipment for over 30 years. Product lines include HS-Tarm and Fröling wood, wood pellet, and wood chip boilers, for renewable heating that is sustainable, clean, and efficient. Tarm products have appeared in GET's print publication and on its web site on numerous occasions. A good example can be found in our article, "Lyme, New Hampshire Elementary School." This can be seen at bit.ly/GET-Lyme-Elementary. The Lyme Elementary School's conversion to wood pellets, installed by Tarm, reduced its fuel needs from 9,000 gallons of oil to 80 tons of local wood pellets.

Froling Energy - Elementary School; Cornish, NH. Project. Their installations in the UV result in a total of 250,000 gallons of oil offset by wood pellets and PDCs (precision dry chips). Courtesy photo from Jim VanValkenburgh.

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
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.efficiencyVT.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
Federal Energy Regulatory Commission(FERC): www.ferc.gov
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**
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Ingredient of the Month

WHAT DOES IT MEAN TO BE GREEN?

By Larry Plesent

Young men standing in a field of green tomatoes in Africa. Photos: Larry Plesent

Everybody wants to be "green." But what does it mean? For some, "natural" is about atoms and molecules. Where did those atoms come from? What was their last incarnation? Carbon for example is an element and as such lasts basically forever, endlessly changing form. Do you support plant-based carbon ("new" carbon) or petrochemical ("old" carbon)? Either way those carbon molecules have existed since the solar system was formed 4.6 billion years ago. I am a plant-based carbon man myself, but everyone is entitled to an opinion as to where they think their atoms came from.

For others, green is about exploitation. Is there blood on my soap? No thank you. In this context green is about compassion. They call these folks compassionate consumers. Unfortunately, nothing is simple and definitions tend to blur as one's perspective takes in the global view. Compassion green screens can be tough to quantify as we lay our societal expectations and conditioning onto other cultures with very different ecosystems, cultural structures and expectations. For example, pretty much nobody likes the idea of child labor unless it's getting our teenage kids to do their chores. But what about a country with a 45-year life span where at nine years old, a child is expected to go to school, work, or to help the parents and family every day. That ten-year-old boy working in an incense factory might seem a victim of unfair and exploitative businesses to us. If that job ends, will his eleven-year old sister be put out onto the street or sold for her dowry ($200 is the normal dowry in much of West Africa) in order to feed a family which does not have access to birth control or even functional health care?

And what about Fairly Traded schemes? Surely Fair Trade is a terrific idea! Well, yes and no. In most West African villages local shea butter sells for about $1/kilo. If I pay the women's co-op $4 per kilo (fair trade) what does that do to the local markets? Quadrupling the cost of shea butter only destroys the local market that cannot afford to pay that much. And if one American buyer pays four times more than the others do, why bother to make and sell it at the lower local price at all? Better to wait around and see if there is another cushy foreign order to fill coming in. And there goes the neighborhood.

For others, green is about pesticides, herbicides and chemical agriculture. Given that organic agriculture techniques yield higher harvests over the long term, build rather than destroy soil, sequesters carbon, has a higher nutritional content to help us fight the unexpected consequences of civilized living, and accomplish its food-raising goals without using persistent poisons; I am shocked and surprised at big businesses' insistence on continuing with agricultural exploitative farming techniques. It is not sustainable to poison the field that feeds you, the workers that make it happen and the end users of the products that you grow. In fact this is exactly the opposite of a sustainable (viable into the future) economy. And yet here we are.

It is important to understand that green is a process, not a result. There is no Greenland in the sky with diamonds, unless you count the one in the far North Atlantic. The best we can do is to be mindful – mindful to minimize the poisoning of our bodies and the Earth, mindful to minimize exploitative business practices and mindful of the interconnected web of modern human life that links that small child on the other side of the world to our beauty care products.

This is the Soapman reminding everyone to live well while trying to eat up the planet as little as possible.

Remember, LIFE IS TOO SHORT TO USE BAD SOAP.

African village girl with baby, laundry and dishes.

Growing the Food We Eat Without Poisons

By N.R. Mallery

Many of us think a product is safe because the manufacturer says so. Monsanto says Roundup is safe, but the state of California and the European Union both specify that RoundUp is a known carcinogen. In fact, its safety cannot really be known because the records may have been tampered with. Recently, unsealed court documents suggest that Monsanto ghost wrote reports issued both by academic journals and the Environmental Protection Agency, downplaying the dangers of their products.

Roundup is, however, not alone. Many herbicides, insecticides, and fungicides turned out to be toxic to humans after manufacturers said they were safe. In the past, DDT and the notorious Agent Orange are among them.

Globally 4.5 billion tons of fertilizers are used every year. Of this, only 20% is actually taken up by the plants it is spread for. About 3.5 billion tons gets into aquifers or rivers. Two billion tons reach the oceans every year, creating over 145 dead zones bigger than the state of Rhode Island. Some of the run-off also pollutes drinking water.

Much of the food we consume has been covered with poisons. Washing it may not be enough to make it safe. Some toxins get into the cells of the food and survive cooking.

Fortunately, there are farming practices that do not depend on the poisons so commonly being put on our food.

Organically-grown food costs a little more but can generally be regarded as safe. We suggest a visit to the Northeast Organic Farming Association website, http://nofavt.org to learn about many safe alternatives.

Green Energy Times regularly has articles on organic and sustainable farming that feature poison-free practices. For those with little space, we might suggest looking at "Indoor Salad Gardening" in our February issue, http://bit.ly/GET-indoor-salad-gardening. Also, look at the book review in this issue, on The Foodscape Revolution, on page 36.

High-quality natural fertilizers are available. One source is North Country Organics, in Bradford, Vermont. They offer a number of safe fertilizers, including one with no phosphates. Its products also include a weed control called Burnout, for a broad spectrum of weeds. It is a safe alternative for RoundUp. Learn more at http://norganics.com/.

Other options to keep the weeds down include GardenMats which are made in Vermont. www.GardenMats.com. Also, heavy mulch keeps weeds under control while providing nutrients as it decomposes. Geese are known to eat the weeds around strawberries and corn, but leave the crop alone. We do not need to put poisons on our crops.

Here are some additional links:

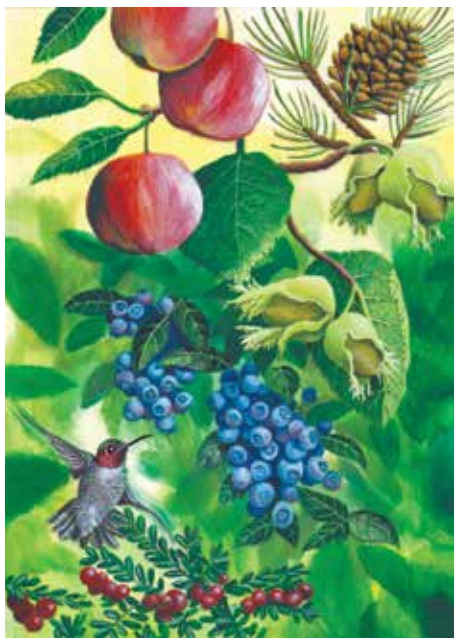
- Ecosmart Products carries a line of weed killers and rely on food grade plant oils: ecosmart.com;
- BioSafe Products, a Connecticut company, produces weed killers certified for use in organic operations (biosafesystems.com).
- Horticultural-strength vinegar (10 to 20% concentration) can be found at many nurseries and hardware stores. It is natural, but it burns and will kill more than weeds, so care is needed. It should not be inhaled and can burn skin, so wear gloves and do not use it on a windy day; Brands to look for include Maestro-Gro Company, Bradfield, and Natures Wisdom.
- Orange oil, such as Nature's Wisdom Orange Oil Concentrate, also kills weeds. This is also for spot treating, without harming the environment. It is biodegradable. Adding a half cup or so to a quart of vinegar increases the vinegar's potency. It sticks to weeds more effectively if you also add a tablespoon of dish soap, like Dr. Bronner's or Vermont Soap Company's Liquid Sunshine (vermontsoap.com). Use it on a sunny day and give the sun time to work.
- And there are always some handy tools that are especially good, like the Cobra-Head, which comes in short and long-handled versions (cobrahead.com).

We encourage you all to consider the consequences of using poisons like RoundUp and discontinue using it for the benefit of all except Montsano, who manufactures and misrepresents the dangers of this dangerous product.

One option to keep the weeds down in both large and small spaces include GardenMats which are made in Vermont. www.GardenMats.com. Courtesy photos.

LANDSCAPES THE PERMACULTURE WAY

Elmore Roots' Permaculture Know-How



Painting by Gabriel Tempesta www.gabrieltempesta.com

It was in the late 70s or very early 80s when I visited my friend who was working at the Rural Education Center in Wilton, New Hampshire. The man who brought permaculture to America, Bill Mollison, had just been there. I bought his books and began the lifelong study and practice of this philosophy.

For the first time, I was shown the relationships between planning and long term results of what we choose to put in our landscapes where we live. I made charts of plants of many uses and had to determine what would grow in northern Vermont, because Mollison's research was done in Tasmania. I fell in love with the Siberian Peashrub. The unusual green bark yielding bright yellow flowers and little dried peas that are released when the pods dry and "do the twist". A good protein source for songbirds, chickens and can also grind and add to muffin batter for us people. On top of all this, they fix nitrogen in the soil and can withstand strong winds!

I began making drawings and then planting shrubs and trees based on what area would be smartest for them to grow in on my own land. The black walnuts that would get tall and shade things and did not require much care were planted the farthest away on the edges of the land. Blueberries that I wanted to snack on frequently and would need to be netted were planted closer to the office. In view from our lunch and picnic table, we could tell when the birds were beginning to swoop down on them that it was time to put up the netting!

Grapes and kiwis, because they are vines, need support. We built attractive and strong arbors and used them as entries for walkways and along paths leading out into new parts of our fields. These paths lead to our pears, plums and apples on a slope where they will get plenty of sunlight but would be too steep for vegetables. A flatter area closer to our house made the smartest choice for the garden. There, we can go out first thing in the morning or even an hour before bed and pull a few weeds or collect salad ingredients.

It seems that landscaping "the permaculture way" means using our wisdom to farm smarter not harder. The plants are here to help us, and we need to learn what plants have what qualities and to use them respectfully and thoughtfully. We don't have much of a say of what goes on in the world around us, but we can plant as many Jerusalem Artichokes or Siberian Peashrubs in key spots around our land as we would like.

In the 1800s there was a summer in Vermont where we did not have more than a few frost-free weeks. Everyone who had them lived on Jerusalem Artichokes. We can plant our favorite pear trees and the Hazelbert bushes we look forward to harvesting. It doesn't hurt to plant a few others that grow no matter what. Grow vegetables in the garden and establish islands for everything else, where each plant can spread out a little and enjoy its place in the sun.

Bonus tip: each fruit or nut tree that has compost and bark mulch around its base to cut down on grass competition, and they can be used as a plant support for growing pole beans, runner beans, garden peas or flowers. Not only will they produce heavily but many will help fix nitrogen for the fruit trees. It will undoubtedly be an interesting sight!

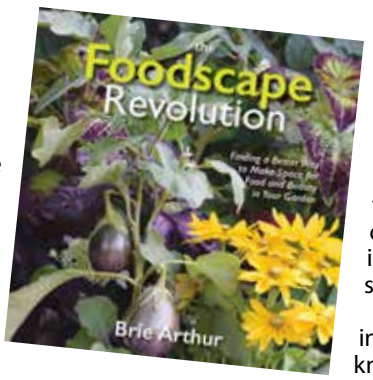
David Fried is the propagator, grower and writer at Elmore Roots Nursery in Elmore, Vermont.

The Foodscape Revolution - Finding A Better Way to Make Space for Food and Beauty in Your Garden

By Brie Arthur

Published by St. Lynn's Press, 2017, 189 pages, $21.95

Book review by N. R. Mallery



'Tis the season for gardening. You may have noticed that some people have been growing a few veggies in with flowers in the past couple of years. Perhaps you have even started to do this yourself as have I. This is not just the newest gardening trend, but is practical and an easy way to save time in our busy lives – yet still be able to enjoy nutritious home-grown organic food for you and your family.

The author, Brie Arthur has taken landscaping to a new level of functionality – in a way that even condominium and apartment rental associations would approve of. Many of us love to have our hands in the dirt and many do not – perhaps just for lack of time, but who does not enjoy eating fresh-picked vegetables for a summer salad or peas, carrots, or broccoli to add to a stir-fry? The taste and nutritional value is priceless. And it doesn't get any more local.

Brie Arthur has been called the number one expert in North America on the newest gardening trend of growing ornamental and edible plants together. And in The Foodscape Revolution, she shares valuable tips and how-to's, including designing, assessing and improving the current landscaping currently being used for non-edible plants, shrubs and trees.

Once the framework is thought out, she basically says to "just add edibles." In chapter three, she calls it "getting to the good stuff: planting veggies, herbs, fruit, nuts and grains!" She claims that "almost every type of edible can find a home in the landscape somewhere."

The expert information on knowing where to do this is clearly laid out, along with companion planting, what works best where and planting the right plant at the right time.

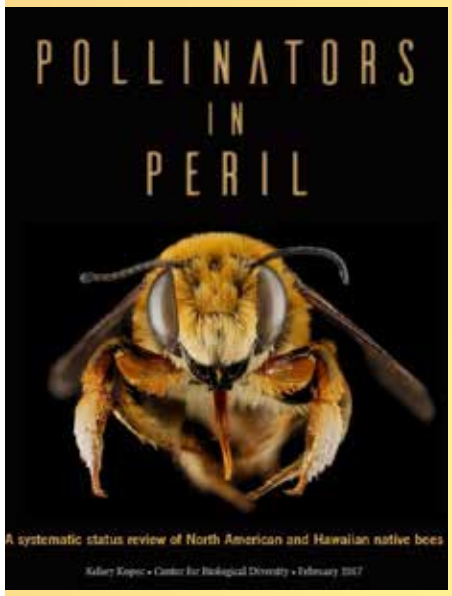
Photos show sweet corn adorning the edge of a lawn as an edible meadow during the summer with corn, sorghum, sunflowers and zinnias – all thriving at the edge of a lawn. Basil makes a great edible border. Hydrangeas provide a sturdy support for large tomato plants and peppers feel right at home in a mixed border of flowers, shrubs and vines. Other beds incorporate lettuces, tomato, eggplant, dill, kale, sunflowers and even ground cover from arugula or pumpkins.

Brie shares growing tips for nearly all veggies and herbs, as well as fruits, nuts and grains. From planting to care and harvest, she covers it all – even if you have no yard – and shows how this is not a problem. So the book really explains all you need to know to go from a yard full of food to table, freezer or cupboard shelf. This is a great book to help on our path towards sustainability – an easier way to grow your own food.

St. Lynn's Press is a new discovery for me. A couple of books that I also have and recommend for the upcoming gardening season are: The Spirit of Stone by Jan Johnsen, with 101 practical and creative stone-scaping ideas for your garden; and The Right-Size Flower Garden by garden expert Kerry Ann Mendez – simplify your outdoor space with smart design solutions and plant choices – to save space, time and energy. This publisher also offers many, many books that will be invaluable as we face a changing world and a changing climate.

Image: St. Lynn's Press

Hundreds of Native Bee Species Sliding Toward Extinction



Landmark Report:

In the first comprehensive review of the more than 4,000 native bee species in North America and Hawaii, the Center for Biological Diversity has found that more than half the species with sufficient data to assess are declining. Nearly one in four is imperiled and at increasing risk of extinction.

The new analysis, Pollinators in Peril: A systematic status review of North American and Hawaiian native bees (1), revealed that more than 700 species are in trouble from a range of serious threats, including severe habitat loss and increasing pesticide use.

"The evidence is overwhelming that hundreds of the native bees we depend on for ecosystem stability, as well as pollination services worth billions of dollars, are spiraling toward extinction," said Kelsey Kopec, a native pollinator researcher at the Center and author of the study. "It's a quiet but staggering crisis unfolding right under our noses that illuminates the unacceptably high cost of our careless addiction to pesticides and monoculture farming."

The widespread decline of European honeybees has been well documented in recent years. But until now much less has been revealed about the 4,337 native bee species in North America and Hawaii. These mostly solitary, ground-nesting bees play a crucial ecological role by pollinating wild plants and provide more than $3 billion in fruit-pollination services each year in the United States.

The key findings:

- Among native bee species with sufficient data to assess (1,437), more than half (749) are declining; (1)
- Nearly one in four (347 native bee species) is imperiled and at increasing risk of extinction.
- Many of the bee species lacking sufficient data are also likely declining or at risk of extinction, highlighting the urgent need for additional research.
- The declines are caused primarily by habitat loss, heavy pesticide use, climate change and urbanization.

These troubling findings come as a growing body of research has revealed that more than 40 percent of insect pollinators are highly threatened globally, including many of the native bees critical to unprompted crop and wildflower pollination across the United States.

To assess current population trends and threats as comprehensibly as possible for the 4,337 described species of North American and Hawaiian bees, Center staff reviewed the current conservation status of 316 species as established by state, federal or independent research. We then conducted a comprehensive review of all available literature on native bees to determine a status for an additional 1,121 species.

"We're on the verge of losing hundreds of native bee species in the United States if we don't act to save them," said Kopec, who spent more than a year analyzing the data. "Almost 90 percent of wild plants are dependent on insect pollination. If we don't act to save these remarkable creatures, our world will be a less colorful and more lonesome place."

The assessment highlights five imperiled native bees that offer a vivid snapshot of the unchecked threats driving declines in many native bee species:

- Yellow carpet solitary bee: This dark, olive-green bee, whose fate is intertwined with its floral host and California's dwindling vernal pools, is severely threatened with extinction.
- Sunflower leafcutting bee: This spectacularly large bee used to be seen patrolling sunflower stands throughout the Great Plains; it is now in steep decline and rarely seen.
- Wild sweet potato bee: Known for its unique three-lobed snout, this bee, once commonly seen foraging across much of the East, is now dangerously imperiled.
- Gulf Coast solitary bee: Completely dependent on the disappearing coastal plain honeycombhead plant and the barrier-island sand dunes where it nests, this bee is now found only within a shrinking portion of its range along the Gulf Coast.
- Macropis cuckoo bee: This nest invader, which takes over the nests of other bee species to lay its eggs, was once common across much of central and eastern North America but is now considered that region's most endangered bee.

(1) http://bit.ly/bees-gone; 2http://bit.ly/bee-list

The Center for Biological Diversity is a national, nonprofit conservation organization with more than 1.2 million members and online activists dedicated to the protection of endangered species and wild places. Contact: (971) 717-6410 or www.BiologicalDiversity.org.

Yellow carpet solitary bee. Photo: dalantech.deviantart.com

The High-Performance ELECTRIC LAWN MOWER

Mean Green's electric zero-turn mower with the optional Solar Assist Module. Courtesy photo.

Adapted from an article by Steven Wisbaum

Until recently, those of us seeking an alternative to lawn mowers powered by fossil fuels only had electric push-mowers of low horsepower (hp) to choose from. While these mowers are relatively inexpensive, their short run-times of 30 to 60 minutes make them impractical for many homeowners.

However, since 2008, Mean Green Products (www.meangreenproducts.com), based in Ohio, has been manufacturing high-hp electric riding and self-propelled walk-behind mowers that run up to seven hours on a single charge, as well as a high-quality 5.5-hp push mower with a run-time of three to four hours.

A majority of Mean Green's customers have been commercial lawn care businesses, college campuses, and government organizations. However, they are now introducing the NXR "Nemesis" 24-hp zero-turn riding lawn mower. With a run-time of up to 2.5 hours and a price competitive with similar gas-powered zero-turn mowers, the NXR represents a welcome change for those who want to mow up to five acres a day.

High-performance electric mowers reduce both noise and pollution. They also have lower costs due to avoided fuel and maintenance. Makers of conventional lawn mowers do not usually publish information about fuel usage but experience shows that those in the 20 to 37-hp range typically consume 1.75 gallons of fuel per hour. If one is operated five hours per week through a twenty-five week season, it would consume nearly 220 gallons of fuel. Replacing that with electric power would save both fuel and emissions of carbon dioxide.

The Energy Information Administration says burning a gallon of gasoline produces about 19 gallons of carbon dioxide. If it runs 750 hours per year, a gas-powered mower using 1.75 gallons per hour would use 1,312 gallons, producing 27,552 lbs. of carbon dioxide each year. An electric mower charged using renewably generated power would produce none.

Mean Green Products' electric mowers consume about 2.8 kilowatt hours (kWh) per hour. Assuming an average electricity cost of $0.19 per kWh for renewably-sourced electricity, the cost of electricity would be $0.53 per hour. By contrast, assuming a cost of fuel at $2.50 per gallon, a conventional mower would cost $4.37 for fuel each hour.

The engines and drive systems of conventional commercial mowers require regular servicing. The repairs often cost hundreds to thousands of dollars per year. Electric mowers on the other hand are relatively simple machines that require minimal servicing with few parts to wear out and break. For example, not only are the Mean Green Products' lithium-ion batteries designed to last 3,000 to 9,000 hours, they can also be repaired if they fail prematurely. This means they should remain in service for at least 12 to 24 years. Mean Green Products' drive motors are similarly built to last many years, but they only cost $200 and are relatively easy to replace.

Because conventional gas and diesel lawn mowers have minimal emission controls, they are a major source of smog-forming air pollution. According to one EPA study, 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.

High-performance electric mowers produce less than half the sound of their gas or diesel counterparts, so electric mowers are being enthusiastically endorsed by groups that advocate for reducing human-caused noise levels and the transition to more environmentally responsible lawn care practices. Such groups include Quiet Communities (www.quietcommunities.org) and the American Green Zone Alliance (www.agza.net).

Steven Wisbaum, of Eco-Equipment Supply, LLC, is the Northeast Region Representative for Mean Green Mowers (http://www.meangreenproducts.com).

Eco-Conscious Residential Lawn Mowing

Residential and small commercial business choices for mowing lawns

Green Energy Times Staff

Each year, we give our readers an update on environmentally-friendly lawn mowers. Part of the reason we do this is that lawn mowing is one of the most polluting activities people commonly do. Fortunately for us, this year we got help from a web site, Wiki.ezvid.com, which supplied ratings for both robotic and walk-behind mowers.

Robotic mowers - Ah! The good life!

Take it easy. You can sit on a lawn chair and watch a robotic mower do your biggest Saturday chore. And it can do that chore so well that your lawn might just look like a golf course. Gas-powered lawn mowers are not just noisy, they are astonishingly polluting and require a lot of maintenance. By comparison, electric mowers are very quiet, non-polluting, and nearly maintenance-free. By going a step further, to a robotic mower, a person can get the anticipated benefit of getting rid of a chore, and the unexpected pleasure of having a nearly perfect lawn.

This year, Robomow won three of the top five positions in Ezvid Wiki's evaluation. This included the number one place. Here is what Ezvid Wiki had to say:

"The folks at Ezvid Wiki spent 29 hours on research, videography, and editing, to review the top picks for this wiki. This robotic mower review is what it's all about when it comes to useful technology. You can use one of these robotic mowers to cut your lawn while you sit back sipping on a cold one. These models can handle everything from a modest yard to a spread of over an acre."

1. "The #1 pick is the **Robomow RS622,** [which] does an outstanding job of cutting uneven and irregularly-shaped lawns, handling up to [3/4] acre and grades of up to 36% with ease. Its feature-rich design includes smartphone app integration, multi-zone functionality, rain sensor and a child safety lock. It also has bagless operation, a modular design with snap on blades, and unique edge mode." [We found these at prices from $2199.]

2. "Using perimeter wire and GPS navigation to negotiate complex spaces and narrow passages with as much as a 45% slope, the high-end **Husqvarna Automower 450X** covers a lot of ground and provides exceptional performance for those who can afford it." [from $3953.95] >>

3. "Slopes of up to 35% are no problem for the **Robomow RC306**, which is designed to crop up to 6,500 square feet of lawn to a uniform height of 3-1/4 inches. Extra-wide wheels and an 11-inch heavy-duty cutting blade make it a powerful tool for remotely trimming the grass." [from $1299]

4. "For automated lawn care on a budget, the **Worx Landroid** offers customizable cutting heights and scheduling to manage lawns of up to one-quarter acre, taking only 45 minutes to charge, and using shock-detection and rain sensors to avoid collisions or inclement weather." [from $923.72]

5. "The **Robomow RS612** can manage slopes with a grade as steep as 36% and features a durable brushless motor and child lock for safety. An included remote control makes it easier to maneuver around tricky lawn features, and a rain sensor helps avoid mowing in soggy conditions." [from $1899]

To see a video of the pros and cons to each of these mowers visit http://bit.ly/ezvid-robotic-mowers.

The publisher of Green Energy Times loves having a Robomow RS622 on her own rural large lawn. See a review in our June 2016 edition of GET on our website: http://bit.ly/GET-it-mows-you-dont. One feature that should be mentioned is that it double mulches the grass as it cuts and never leaves anything to be raked up later.

This mower's easy operation has freed up innumerable hours of work, and it keeps this former pasture looking like a golf course – always! It has no emissions, uses no fossil fuels, and requires no human attention. It is great for off-grid lawns too, with minimal draw on a battery bank. If on the grid, it uses less than $30 of electricity per season at present electric rates. But please consider having some solar to make your electrical consumption as clean as possible, and making your lawn mowing downright good for the planet.

Husqvarna Automower 450X

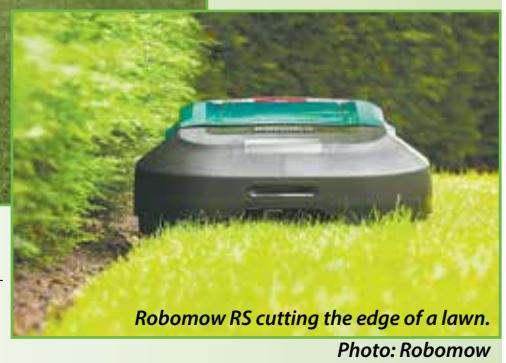
The Robomow RS622 in action, mowing a rural large lawn in Vermont. Courtesy photo.

New for 2017!

Robomow is debuting a new smaller model this summer: the RX12!

The RX12 covers up to 2,000 sq ft. and will also have a lower price: $699.

Read more at: https://robomow.com/en-GB/platform/rx/



Robomow RS cutting the edge of a lawn.

Photo: Robomow

Walk behind mowers – for those who insist on doing it themselves

We recommend you consider these battery-powered lawn mowing options, if you have free time to spare. For the full rating, visit Ezvid Wiki at http://bit.ly/ezvid-electric-mowers.

1. Ego Power Cordless [from $329.99]
2. Sun Joe iON16LM [from $199.99]
3. GreenWorks 25022 [from $147.99]
4. Earthwise 50214 [$138.49]
5. Worx WG782 [$195.08]

Riding Mowers

We were able to find the following electric riding mowers

1. Mean Green Nemesis NXR is a commercial mower, but they just came out with a version that is great for large residential lawns and with a lower price than the commercial versions. *Please see the article on page 38.*
2. Cub Cadet RZT S Zero [from $2,699]
3. Ryobi RM480E [from $2,699]