Keeping a natural product natural with renewable energy and more

By George Harvey

Old-time pictures of traditional maple sugaring are deeply ingrained in the minds of many of us, and not just those of us who grew up long ago in Vermont or New Hampshire. Covered buckets hanging from taps on trees, people trudging through the snow with buckets of sap, horse-drawn sledges with tanks, and open-air evaporators are all part of scenes many of us easily remember, even if they are from before our times. We know them from quaint photographs and paintings by such illustrators as Norman Rockwell, Grandma Moses, and Currier and Ives.

In those days, the work for the next year's harvest started with cutting many cords of firewood to boil sap. It was an energy intensive operation, both in terms of human labor and in the quantity of wood. In the days before trucks and chainsaws, maple sugaring might have produced quaint pictures and fond memories, but it was not easy.

Through the years, maple-sugaring operations turned progressively toward methods that reduce labor. Oil has been used for fuel and gas-powered engines do much of the work.

Recently, however, standards have updated again. The predictable maple sugar producer’s love of the land has started to transform the industry to practices chosen for sustainability and low pollution. Today, some local operators have turned the corner, giving up on fossil fuels almost entirely, making them nearly 100% dependent on renewable resources.

Some maple sugaring operations have gone back to wood to fuel evaporators. But boiling sap is not the only process on the farm that takes a lot of power. Buildings need to be heated and powered with electricity, and vehicles need to be fueled. Turning from grid-powered electricity to solar is an obvious step. So is heating buildings without fossil fuels, and even going to bio-diesel for vehicles.

We were surprised to discover there is a lot being done in other areas we did not think of right off. A look at a few of the maple sugaring operations in Vermont and New Hampshire provides some great examples.

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SOLAR IS NOT TOO EXPENSIVE - SOLAR COSTS LESS THAN YOUR ELECTRIC BILL!

GET staff article

Solar PV has never cost less! Solar module prices continue their free fall, largely driven by global market fundamentals - high installed capacity, Chinese government subsidies on their domestic manufacturing, and global recessionary pressures.

Top-of-the-line modules, which were at $2.25/watt as recently as in 2010, are now closer to $0.75/watt! Consequently, total installed price for roof-mount PV is in the $3-$4/watt range, and about a $1/watt more for ground/pole mount PV. It is not necessary to have a prime site for installation either, because it is possible to buy membership in solar cooperatives for $4/watt.

Checking with local installers proves the point. We got this from Power Guru in North Bennington, Vermont: “Roof-mount grid-tied PV is now as low as $3.50/watt for systems in the 3-5kW size range and $3/watt for larger systems. Lifetime Cost of Electricity with PV is now in the $0.12-$0.15/kWh range, even before incentives.

- i.e. grid parity is now a reality!

What does this mean for you? As a rough rule of thumb for solar PV output in the Northeast, 1kW of solar (4 modules of roughly 3x5’ each) generates 1,000kWh of electricity per year. Since modules are warranted for 25 years, over their warranted lifetime they would produce 25,000 kWh at a total upfront cost of $3,500 or less, before incentives.

Cont. on page 20
Cut Your Heating Bills in HALF!

We want to extend an apology and a correction for our front cover story. Cut Your Heating Bills in Half, that was published in our Dec. 15, 2013 issue of G.E.T. The caption and photo credit was inadvertently left off.

The Moretown, VT house called Greenstone, won the 2013 Better Homes Awards (HBRA)’“Most Energy Efficient Home” as well as “Best Home 2001 s.f. to 3000 sq.”. The Mitsubishi MSZ-FE24NA mini split heat pump is the only heating/cooling in the house, although it is only used for backup. Note the 7.1 kW solar photovoltaic system, on the roof of the picture above. The house was built by Turtle Creek Builders in Waitsfield, VT.

Also missing was a picture of Tony Klein, whose testimony included the article, but the picture that we had intended to include was not published. So, we would like to include it here. Apologies, Tony. Thank you for allowing us to share your great story about your experience with heat pumps in your home. We hope that your example will help others understand their value and how they can cut heating bills in half.

Here is a re-print of his story:

One person who has looked into heat pumps and decided to install them in his house is Tony Klein, Vermont State Representative for East Montpelier and Middlesex, Vermont. Since he is the Chairman of the House Natural Resources and Energy Committee and the Joint House and Senate Energy Oversight Committee, we imagine he did his homework on the subject. Tony says, “I am convinced that heat pumps will substantially lower my cost of heating this winter.” Noting side benefits of having air source heat pumps, he adds, “Mainly we had them installed to provide air conditioning in the summer and to solve a downstairs humidity problem.” Tony chose Cacisco Heating in East Montpelier to install Mitsubishi “Mr. Slim” units for the lower floor of his ranch house and two upstairs rooms. He said the cost of the units was about $8,000. Noting that there were no incentives to apply to their purchase, he added, “If I were a GMP customer there would have been incentives.” He expects to cut his propane heat cost by 70% and electricity bill to increase by 20-25%. These figures would produce a net saving of over $1,000 per year. “I couldn’t begin to tell you the science behind it,” Tony says. But he adds, “So far the house is way more comfortable.”

Tony Klein, VT State Representative.

The background picture was taken in the fall of 1971, when Tony was 24. The inset is recent. Photos courtesy of Tony Klein.

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G.E.T.'s Carbon Footprint Disclosure: Green Energy Times is printed on a lot of recycled content paper as one can get locally. The printing process uses eco-friendly water-based inks. Of course we buy as much as we can. Greenstone, won the 2013 Better Homes Awards (HBRA) “Most Energy Efficient Home” as well as “Best Home 2001 s.f. to 3000 sq.”. The Mitsubishi MSZ-FE24NA mini split heat pump is the only heating/cooling in the house, although it is only used for backup. Note the 7.1 kW solar photovoltaic system, on the roof of the picture above. The house was built by Turtle Creek Builders in Waitsfield, VT.

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Tony Klein, VT State Representative.

The background picture was taken in the fall of 1971, when Tony was 24. The inset is recent. Photos courtesy of Tony Klein.
**VIEW FROM THE TOP**

**Picking Up the Pace to Reach 20% Renewables by 2020 – Part Two**

David Blittersdorf’s

Vermont’s current statewide comprehensive energy plan calls for 25% of our total energy to come from renewable energy sources by the year 2050. At the Renewable Energy Vermont conference in Burlington last October, REV leadership publicly announced the need for immediate progress toward the next step along that path: a more modest goal of 20% renewable energy by 2020.

(Remember that our statewide figure for total energy use includes all electricity and fuels, including those used for heating and transportation.) In my last column, I outlined the specific roles that energy efficiency, conservation and solar energy would need to play over the next seven years for Vermont to meet its 2020 energy goals. Those three areas alone would enable us to realize 74% of our 2020 target amount. Here, I’d like to look at developing other systems and resources over the next half-decade to account for the remaining 26% of energy required to fully meet the 2020 goals. That smaller share breaks down to wind energy at 15%, biofuels at 10%, and in-state hydropower at 1%.

Wind Energy. We will need to build another 225 MW or 68 MW average** of wind power capacity installed in Vermont. Four wind farms are currently operating across the state: Searsburg (6 MW, commissioned in 1997), Sheffield (40 MW, 2012), Lowell (63 MW, 2012) and Georgia (10 MW, 2012), along with approximately 1 MW of small wind turbines at homes, schools and businesses. Out-of-state wind energy has been purchased by Green Mountain Power (54 MW), and the Burlington Electric Dept. is contracting for about 13 MW. Assuming that our Vermont utilities may contract for another 38 MW of out-of-state wind energy, we will need to permit and build another 120 MW of wind in VT by 2020. That is an amount equal to the 120 MW we built over the last 20 years. There are wind projects currently in the measurement and permitting phases (Seneca, Grafton, Deerfield) that could fulfill the majority of this 120 MW goal. Additionally, multiple smaller five-to-ten MW community-scale wind farms could be built. These local projects could leverage local ownership and financing, and potentially use group net metering to allow Vermonters near the turbines to benefit directly from the fixed-price electricity. (This is common in Denmark and other Scandinavian countries that have pioneered successful and economically equitable community-scale wind.) We need to expand net metering up to at least 5 MW worth of small wind farms so that local people can buy electricity produced via local wind energy.

Biofuels. Most of the biofuels we will be able to harvest sustainably in Vermont will come from biomass, mainly wood. To get to 45 MWavg of energy from biofuels, we will increase the use of wood pellets and wood chips. In order to meet our efficiency, any electricity from biomass will need to come from combined-heat-and-power district heating systems, where waste heat from burning fuels for electricity is captured to heat a town or neighbor- borough. Other biofuels such as biodiesel will be small contributors to our heating and transportation needs. I am not a big supporter of burning stuff or trying to use...
ALL ABOARD! RAIL IN VERMONT

VRANS Highlights and Accomplishments
By Christopher Parker

Vermont Rail Action Network attends meetings at the state house and with the Agency of Transportation. We engage the railroads and Amtrak. We show up around the state, engaging the public. We even went to Washington DC, advocating for better trains in Vermont.

In-state Amtrak fair

The popular $12 in-state Amtrak fare will continue in 2014 with a new fare code: V657. The Amtrak website has recently changed, making it harder to book this fare online. You can call 1-800-USA-RAIL, but you must ask specifically for the discount. Reservations must be purchased at least one day prior to travel. The fare is only available on certain peak travel days and has limited availability, so do book as far ahead of time as you can.

TIGER Grant

Vermont succeeded in receiving a federal TIGER program grant for the Western Corridor. When the work is done only 12 miles of rail will remain to be redone between Rutland and Burlington, as well as some bridge and crossing work. The upgrade will enable competitive speeds for a planned extension of the Amtrak Ethan Allen line to Burlington by 2017.

VRAN has made investing in the Western Corridor a priority and continued to advance it with the Agency of Transportation, the Governor and in Washington DC.

Bikes on Trains

VRAN has been actively advocating for

Cont. on page 5

44% of greenhouse gasses in Vermont are produced by transportation. If you want to support the environment, transportation is the next place to look. Photo courtesy of VRANS.

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 $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 (UVR) - 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 Services. 802-295-1824, advancetransit.com CARROLL COUNTY TRANSIT - Services and connections to Belknap County. 888-997-2020 tccap.org/ntc.htm

CITY EXPRESS - Serves Keene. 603-352-8494 hcservices.org/services/transportation/cityexpress.php

COMMUNITY ALLIANCE TRANSPORTATION - Services for Claremont & Newport. 603-863-0003

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 TRANSPORT 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

WINNIPESAUKEE TRANSIT SYSTEM (WTS) - Services Belmont, Franklin, Tilton, Laconia. 603-528-2496

IN VERMONT

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

VERMONT PUBLIC TRANSPORTATION PUBLIC TRANSPORT - Lists transit, ferries and more at: ase.tvt.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. cctarie.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. rail-vt.com

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

STAGE COACH - Buses from Randolph and Fairlee to Dartmouth, & local village. 800-427-3553 stagecoach-rides.org
FUEL FROM WASTE AT THE PUMPS

By George Harvey

It was not all that long ago that waste of all kinds was simply dumped into rivers. There were no laws to protect the environment, and conventional wisdom was that the environment could absorb just about anything we wanted to throw at it, from plastic bags to plutonium.

Today, we are seeing a better way emerging. We are starting to understand the value of waste. It is not something to throw away—it is too valuable. Whether it is landfill waste, manure or human waste, food scraps, or previously unusable agricultural by-products, it is worth money. Why? The reason is that it can be converted to fuel or feedstock for a variety of things ranging from automotive fuel to plastics.

Last fall had a number of interesting news stories about waste. Each was of itself rather small, but when they are seen together, they show a trend that may eventually be highly significant.

One story is about ‘bio-methane,’ a drop-in replacement for natural gas. It has been used for some years to fuel power plants, but the news had a new twist. A company called Clean Energy is marketing bio-methane, under the trade name, “Redeem.” They have put it on sale in over thirty gas stations in California, where vehicles equipped to run on natural gas can fill up.

The process of making Redeem takes municipal or agricultural waste and turns it into a number of different things. One is bio-methane. Another is compost that can be used agriculturally. By-products exist, but they are relatively benign. The process uses agriculture waste that would otherwise decompose partly to methane, which, if uncontrolled, is far worse than the carbon dioxide released by vehicles. The carbon atoms in the process were recently in the atmosphere, and the fact that the carbon is being recycled through the atmosphere makes it possible to regard the process as carbon-neutral.

In some places, bio-methane is already being run into existing natural gas lines. As a by-product of agricultural and municipal waste, it can be less expensive. It requires some processing before it can go into the lines, however, and does require a bit of attention from the people who make it.

On the plus sides, it is a product that can be made wherever there are farms or municipal waste, and it does not require extensive, continental-scale transportation infrastructure. Other benefits are that when it is properly made, it does not contain sulfur compounds or radon, and so it can be cleaner than natural gas, entirely apart from the fact that the carbon footprint is at worst tiny, compared to natural gas with a much larger carbon load.

It is somewhat costly, but methane can be converted to such things as gasoline and diesel oil, along with such lighter fuels as butane and propane. The processes that are used to do this have been known since the 1930’s and before. So, as newer, more efficient, and less costly processes are developed and the prices of fossil fuels increase, we are also likely to see gas-to-liquid plants built making local fuel from local waste.

Right now, bio-methane is about the same price as natural gas at the gas stations that sell it, which makes it less expensive than gasoline or diesel oil. As technology for making it improves and the costs of fossil fuels continue to go up, we can doubtless expect to see more of it.

ALL ABOARD! RAIL IN VERMONT

Cont. from page 4

carry-on bikes on Amtrak trains, working with the Vermont Bike-Ped Coalition and the state of Vermont. We can now report that Amtrak has tested a car with bike racks, and details are being worked out for this service on the Vermonter and Ethan Allen.

Trains to Montreal

The cost to extend the Vermonter to our nearest big city is low, but the complexity of dealing with two customs services and Canadian unions is high. We do need the support of congress members beyond Vermont and New York to finish the work. Please spread the word among your friends in other states to write their representatives.

Regional Cooperation, VRAN works in affiliation with Trainriders/Northeast of Maine, the National Association of Railroad Passengers and other regional advocacy groups.

Commuter Trains in Burlington

We’ve had conversations and helped refine plans for a future effort to establish a Middlebury-Burlington-Exs Wool Junction - Saint Albans/Montpelier Junction network.

Converting Freight Shipments to Rail

We are pursuing several opportunities to convert significant truck flows in Vermont to rail freight. This has involved putting together ‘win-win’ proposals that make rail shipment attractive as well as profitable. Our role is to bring people together.

Christopher Parker is the Vermont Rail Action Network Executive Director.


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WITH THE CAR UNDER SCRUTINY, CARGOBIKES ARE ON THE RISE

By Dave Cohen

Chickadee came up to them. “Nobody around,” she said in her small, dry voice, “but there’s one of those fast turtle things coming.” Horse nodded, but kept going forward… and then in the distance something moving fast, too fast, burning across the ground straight at them at terrible speed. “Run!” she yelled to Horse, “run away! Run!” As if released from bonds he wheeled and ran, flat out, in great reaching strides, away from the fiery burning chairo, the smell of acid, iron, death.

In this passage from Ursula Le Guin’s short story “Buffalo Gals, Won’t You Come Out Tonight,” animals glimpse a familiar moving object blazing toward them. To us, that object “burning across the ground straight at them at terrible speed” is so easily articulated in our familiar coded language - “car” or “automobile.” But to the greater world it is experienced as something profoundly different. Any way you look at it, the unbridled deployment of the massive number of automobiles on our landscape is deeply undermining our bodies, our soundscapes, our sense of place, the global ecology and so many nooks and crannies of this world we could never know about. And yet even witnessed the coming invasion of self-driving cars - the “carbots.” They’re approaching way faster than you can ever imagine. All that said, e-cargobikes are not a silver bullet that will solve all our transportation challenges. If you want a silver bullet you get the car. I believe some part within every one of us understands what that means, even beyond what we know about climate change, carbon footprints and endless shopping malls.

In merging with the car we become partly what it is - robotic. And we haven’t yet even witnessed the coming invasion of self-driving cars - the “carbots.” They’re approaching way faster than you can ever imagine.

Can we hear chickadee’s alarm at the “fast turtle things”? If so, perhaps our response shouldn’t be about accommodating our current dystopian world. Maybe we can bring forward our human potential - our attuned senses, strong bodies, emotional intelligence, and imaginative minds - fully engaged to work towards creating a world we and our children actually want to live in. I think that exactly the moment when something like the cargobike will truly shine.

Dave Cohen (www.davecohencounseling.com), is a psychotherapist and an ecopsychologist in Brattleboro, VT, blending body-oriented and mindfulness therapies with approaches that draw on the healing potential of the natural world. As founder of Pedal Express, a nationally-recognized cargobike delivery service in Berkeley, CA, he continues to ride and promote really big bikes for everyday use. He and his family are sighted nearly daily on their bright orange e-cargobike in the Brattleboro area.
COMMUNITY NEWS

ANTIOCH STUDENTS AND MSN BRINGING COMMUNITY SOLAR TO MONADNOCK REGION

By Tracy Bartella

This spring, a group of five students from Antioch University New England are teaming up with the Monadnock Sustainability Network to bring community solar to the Monadnock region.

Gaining in recent popularity across the United States, community solar projects are already owned systems that provide energy and financial benefit to multiple members of the community. The adoption of the title Monadnock Community Solar Initiative, or MCSi, is a reflection of the group’s strong focus on local community and solar energy, from including in its name the symbol for the element silicon (Si), a primary component of solar cells.

Mari Brunner, an Antioch student completing this project for credit toward her Master’s in Environmental Studies, is excited about the community solar initiative because she sees it as a great opportunity for people throughout the community to invest in renewable energy, support fellow community members, and gain a small financial return themselves. She also highlights the long term benefits of community solar projects, including greater innovation within the energy sector. “Community solar has many benefits,” she said. “It is a hedge against rising fuel costs, it reduces emissions of pollutants and carbon, and it drives energy independence.”

Falling installation costs and creative new financing models have made solar projects more financially feasible, and funders can expect to see a return on investment in as little as five years. “Community solar is an emerging segment of the fledgling solar market,” states John Kondos, a founding member of the Monadnock Sustainability Network and local energy company Solar Source. “Commercial solar continued to grow last year and large scale utility projects were the largest segment of solar installed in 2013. There are already several community solar systems just across the river in Vermont.”

Kondos went on to explain, “The Monadnock Community Solar Initiative (MCSI) is a result of the folks behind the Brattleboro Co-op PV solar system speaking at Keene Green Drinks last fall. If they can do it, why can’t we?”

The Antioch team will release an initial feasibility study for the project in mid-March and propose siting alternatives for the final location of the solar electricity system. MCSi is currently looking to form a group of core citizens who will help develop, fund, and implement the project.

Local citizens interested in learning more about this exciting opportunity should contact John Kondos at jkondos@home-efficiency.com for more information.

Tracy Bartella is part of the Antioch University student project group that is working with the Monadnock Sustainability Network to initiate this community solar project in the Monadnock region.

SOLARIZE NORWICH 2014 CAMPAIGN LAUNCHED

By George Harvey

Through the two successful Solarize Norwich campaigns in 2012 and 2013, total residential solar PV capacity in Norwich has grown from about 143kW to 267kW — close to doubling! Their new goal is to top 400kW in 2014. Once again they will be working with two Norwich-based firms, Norwich Technologies and Solarafact. The two companies have focused on reducing the costs associated to the support and mounting structures for, respectively, roof- or ground-mounted fixed and pole-mounted tracking solar systems. Depending on your site, at least one of these set-ups is likely to be a good match.

The campaign includes a community solar option suitable for renters or homeowners whose sites are shady, making PV there not feasible.

This is another opportunity for Norwich residents to take action to cut their personal energy bills and their carbon footprints. To learn more, contact Linda Gray (linda.c.gray@gmail.com).

SOLARIZE UPPER VALLEY PROGRESS CONTINUES

By Sarah Simonds

In the December issue of Green Energy Times, we announced Solarize Upper Valley, a new program from Vital Communities which teams up communities with local solar PV installers for a series of 15-week outreach campaigns aimed at doubling existing residential solar PV in each community.

Spring 2014 Solarize Upper Valley Communities were selected last month:

• Solarize Cornish-Plainfield!
• Solarize Lyme!
• Solarize Strafford-Thetford!

The three communities will be reviewing bids and selecting their partner installers at the end of February.

Though Solarize Upper Valley will officially kick off in March, teams in the three communities have already met to begin planning outreach activities between now and the June 30 program deadline. If you live in one of the Spring 2014 Solarize Upper Valley Communities, you can expect to learn more at your town meeting.

The Spring 2014 Solarize Upper Valley Communities will each host a Solarize launch event in March, followed by workshops, open houses, tables, posters and more. All this is designed to connect residents with highly competitive pricing and trustworthy resources to make the process of going solar as simple and rewarding as possible.

Be sure to check online for upcoming Solarize news and events, and to sign up for Solarize email updates, and to learn more about how to get involved. www.VitalCommunities.org/Solarize

Even if you don’t live in one of the Spring 2014 Solarize Upper Valley Communities, visit the Solarize Upper Valley website this spring for useful resources about solar energy opportunities in the Upper Valley, for QUALITY solar installers, and more information. Questions? Contact Sarah Simonds: Sarah@VitalCommunities.org.

SOLARIZE PUTNEY SOLARIZE WINDHAM COUNTY!

By Daniel Hoviss

The Putney (VT) Energy Committee in partnership with two renewable energy companies presents an affordable alternative to the high up front cost of solar installations — Solarize Putney. This program seeks to increase the use of small-scale renewable energy in the Putney area. This model will reduce costs for all participants by providing a competitively tiered pricing structure.

As more home and business owners sign contracts for systems, the price of each system will decrease, increasing the value for everyone.

PEC is partnering with RGS Energy (formally Real Goods Solar) for solar electric installations, and with Sunward Systems for solar hot water and space heating needs. Both companies are collaborating to provide customers with affordable, reliable, renewable energy.

Both ground- and roof-mount options will be available from each company. Solarize Putney will hold a kick-off event on Saturday, March 15th at the Putney Community Center. The evening will begin with a 6:00 pm dessert potluck followed by a brief presentation that will make economics sense, and culminate with live music and dancing. Real Goods Solar and Sunward Systems will have representatives at the event that will be happy to talk about your needs.

Customers who join the program at the kickoff event will receive an extra installation discount.

Here’s how Solarize Putney will work:

Home and business owners who want to participate will pay a small, refundable deposit. Installers will provide a site assessment, estimate for the cost of the installation, an explanation of the state and federal rebates and incentives that are available and a net payback period or return on investment calculation. Participants who sign a contract for the work will make a down payment, and once the system is completed, a final payment. In addition to state and federal incentives, home and business owners who sign up early may also be eligible for Solarize Putney incentives.

Businesses may also receive other tax advantages during the first five years after installation.

Through the Solarize Putney program, Putney Energy Committee volunteers aim to increase the adoption of small-scale solar hot water and electricity systems and reduce our town, and area’s, reliance on fossil fuels and imported energy.

Contact Daniel Hoviss 802.254.1410 or Daniel@putney.net for more information or to schedule a site visit in the Putney area.

The program is modeled on Solarize Northampton, through which more than 110 homeowners installed 739 kW of solar electric systems. The 2011 and 2012 Solarize Mass programs resulted in more than 900 residents and business owners in 21 communities installing 5.6 megawatts of solar electric capacity.

The Solarize Windham program will roll out across other towns in Windham County during 2014, following the successful model of Solarize programs in central Vermont and western Massachusetts. If you are located in Windham County, VT, and want to get your community involved, schedule a site visit or want more information about the Solarize Windham program, contact Tad Montgomery of Home Energy Advocates: 802-251-0502 Tad@HomeEnergyAdvocates.com.
SOLAR IS NOT TOO EXPENSIVE - SOLAR COSTS LESS THAN YOUR ELECTRIC BILL!

Price of Crystalline Silicon Photovoltaic Cells $/watt 1977 - 2013

Cont. from page 1

and tax credits. This means you would be paying 14¢/kWh for your own solar electric generator, which is almost certainly less than you currently pay for grid electricity from your utility.

You ARE already at below grid parity even before incentives! Add in incentives and the cost of solar electricity is typically under 10¢/kWh for clean, renewable, locally generated solar electricity! Even with financing, at today’s low interest rates and long terms, your monthly payments should be lower than grid electricity would cost. The solar PV will replace your electric bill -- you will not have two bills.

Solar PVs can provide a fixed rate for power until they are paid off, for which utilities cannot offer. It gets even better after they are paid off, because that is when the electricity becomes free. Also, the warranted period is probably just a portion of the actual life of the solar systems. There is no real clear idea of how long they last because so far, nearly all of them just keep working. Normally, they simply do not wear out.

Should you act now, or later?

The SunShot Initiative, part of the US DOE, is aiming to reduce the installed costs of solar to $1/watt by 2020. There is reason to believe they could succeed. The current problem with the price of solar power is the so-called soft costs, including permits, licenses, and such business costs as advertising. Reduce these, and there is a substantial reduction in the cost of solar.

This brings up the question of whether it would not be better to wait until costs go down even more. The answer is simple. Since you start reducing your costs immediately, waiting until later involves buying grid power, probably at increasing rates, for years before you act. The longer you wait, the more you will have paid into the grid.

Solar Costs - From 2004 to 2014

In 2004, this 3.8kW off-grid ground-mounted solar pv system was designed to produce 11.5 kWh/day. Installed Cost: $34,500 ($9/W)
In 2014, the cost for a comparable 3.8kW system: $15,200 ($4/W)

Photovoltaic system: 24 BP 160 W, 12 VDC panels (3,840 W, 48 VDC); 3 Pole-mounted UniRacs; Trace/Xantrex SW4048 Inverter (4000 W); 2 Outback MX 60 MPPT charge-controllers; 3 array combiner boxes; 4 lightning protectors

So the bottom line is that there may be no better time than right now to buy solar PVs. There may not ever be a better time than NOW to go solar. If you can afford to buy electricity, you CAN afford solar power! Is there a better investment that you can make - for yourself or for our future?

By Mike Hamlin

New inverter heat pumps are very different from their early predecessors. The new inverter-driven technology enables the heat pump to transfer heat from the outdoors to the indoors extremely efficiently and reliably at temperatures well below 0º. The use of “intelligent” smart controls allows for the heat pump to ramp up and down as needed, thus making the inverter the most efficient heat pump ever produced. So, how can an inverter heat pump triple a PV solar array’s return on investment (R.O.I.)? Let’s do the math.

Let’s take a modest new energy-efficient home of say 1900 sq. ft. with two people living in it. General electrical usage would be approximately 6000kWh annually, including an electric hot water heater. Annual heating BTU’s would be approximately 60,000,000 (60MMBTU).

The new home has been equipped with a “Net-0” 6kW solar array to cover the annual electrical needs and has a highly efficient 95.5% A.F.U.E propane furnace. Electrical rates in the region are @ 16.3¢/kWh (kilowatt hour) and propane costs are $3.69 per gallon. A KWh is equal to 3,410 BTU’s. A gallon of propane is equal to 91,500 BTU’s and at 95.5% A.F.U.E has 87,383 usable heating BTU’s. Annual electrical cost $ .163/\text{kWh} \times 135 \text{kWh} = $22.00. That’s actually 135kWh less than our PV array produces. Our annual propane costs are $3.69 \times 687 \text{gallons} = $2,535.00 annually. So, we don’t need anywhere near that much electricity. As a matter of fact, heat pumps can move as much as 4.2 times the heat as the heat value in the amount electric power they use. However, we will be very conservative and will use a 10.3 HSPF adjustment or 3 coefficient of performance (C.O.P.) rather than a 4.2 C.O.P. This is known as the Heating Season Performance Factor (HSPF). So, let’s divide 17,595kW by a 3 C.O.P. and we only need 5865kW to produce 60MBTU. That’s actually 135kWh less than our PV array produces. Now, here is the bottom line. We saved $2,535.00 in propane costs using a heat pump. We had 135-kw left over for the general electricity, at a savings of $2,868.00. But, wait a minute, we’re not generating heat with a heat pump, we’re just moving it from one place to another, so we don’t need anywhere near that much electricity. A projected system with PVs powering a heat pump has a 4.21 year pay-back period and saves $55,454 over 20 years.

Go Green With Solar Power

A solar array can cover all or a portion of your electricity with a solar photovoltaic system at your home or business. Example: 6000 watt array installed at $3.25/watt.

6000 Watt Array Installed at $3.25/watt

- Federal Tax Credit = 30% of installed cost
- NH State Rebate = Up to $3700 (residential)
- NHEC Co-op Rebate = $2500
- Your Net Cost = +$7400

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By Mike Hamlin

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Staff Article
This is the first of many in our new feature that we will be running in Green Energy Times, which will be highlighting our local solar installers.

As one of our longer standing Solar Installation companies in our region we would like to introduce you all to Integrated Solar Applications Corp. (ISA), 121 Spring Tree Rd, Brattleboro, Vermont.

ISA was founded in 1975 by Alain Ratheau, an electrical and mechanical engineer. In those days the organization was the Solar Applications Company. Over the years, Alain designed and installed both solar thermal and solar PV systems. In April 2008, Andrew Cay acquired Solar Applications Company and changed the name to reflect a focus on combining technologies to achieve net-zero energy solutions. Andy had received a BS in Mechanical Engineering from Worcester Polytechnic Institute with Distinction and an MBA from the University of North Carolina, before being involved in a number of capacities in the fields of engineering, energy efficient housing, and real estate. Andy put together a team with a very diverse background. The result is that ISA can handle a good deal more than a simple set of solar PV solutions. They can work on small wind turbines, geothermal applications, and solar hot water. And Alain continues to work with ISA as a lead engineer and system designer, giving a sense of long-term continuity to the business.

Continuity goes beyond the presence of long-term staff. ISA has repeat customers with a sense of customer loyalty. In fact Andy Cay’s first customer, Abenaque Car Wash, has come back for seconds, a repeat of the same design at a different site.

ISA is able to design for solar PV, solar thermal, and heat pumps to produce an Integrated System. For example, a PV system can be built to provide power for a geothermal heat pump. If the system is designed, installed and maintained at optimum size and capacity, it can be a Net Zero system, meaning that the sun powers the buildings heat in a way that is more efficient than even direct heating. If other things are needed, such as air-source heat pumps or wind turbines, ISA is happy to connect clients with people who specialize in those sorts of things.

The range of work ISA does is quite broad. They design and build small household power and heat systems. They also work on commercial and industrial systems, and community and municipal systems of all sizes. They have been at this like of work for almost 40 years, and have a wide range of installations they can show. Andy Cay, owner of ISA, was good enough to answer a few of questions for Green Energy Times:

Q: What are your thoughts about solar and climate change?
A: “Solar is a very important arrow in the quiver – part of the solution – an important part of the solution to help combat climate change. Combined with geothermal, wind, and hydro, we can have a renewable energy future.”

Q: What led you to buy this company in 2008?
A: “I was developing real estate and worked with Alain Ratheau, who helped to install solar on some projects. Al Gore’s Inconvenient Truth came out just before this, and it had big impact on me. He had a very compelling argument. The move was the right fit for me personally – it was where my heart wanted to go. I have a building and engineering degree, VT plumbers license, a BS in Mechanical Engineering, and an MBA in Business”.

Q: I notice you mentioned a VT Plumbing license. I recall featuring a story about you a few years ago in Green Energy Times about a SHW powered carwash there in Brattleboro. Did you start out with SHW installations?
A: “Yes, I did start out with Solar Thermal systems. The Abenaque Car Wash is doing very well. In fact, in Chester, VT, we are installing a 2nd one, designed exactly like that one. It is doing well enough that they want to do it again. 120ºC water is perfect for car washes. Laundromats are also well suited for Solar Hot Water. When the oil prices went up to $4.75/gal, solar thermal was a great alternative. Solar thermal is still an attractive technology. But since then, Solar PV has dropped dramatically from $9-$10/Watt in 2008 to $4/W today, so PV is now dominating the market. Even in 2008, photovoltaics were a good choice, but it an even better choice now.

Q: What kind of totals for Solar PV have the past years been for Integrated Solar?
A: From 2012 to 2013, installations increased by 50%. They installed 770kW total solar in 2013. ISA has 4 MW solar PV projected for 2014 – more than another 50% from last year.

Andy points out that the federal incentives program may end in 2016. Federal tax credits have been a major driver of the solar industry, and a sense of urgency is developing, as we get closer to that date. We will have to see how the next steps develop, as laws may be revised before then.

Learn more at (802)257-7493 | www.ISASolar.com
Staff Article

A system at Bistro Henry in Manchester, Vermont is the largest solar tracking project in the region. It will provide all the energy needed for lighting, refrigeration, and air-conditioning at Bistro Henry, with some left over for heating. With 60kW of PVs, mounted on ten dual-axis AllSun Trackers, the system will produce about 87,000 kWh annually. The net-metering credits it produces will be shared with the Inn at Manchester and the owner’s household.

“I am proud to say that Bistro Henry is the Greenest Restaurant in Manchester and has been a leader in sustainable business practices,” owner Henry Bronson said. “In 2010, we installed a solar thermal system to heat the restaurant’s water and now we are thrilled to have our restaurant become solar powered, too!

“We’ve taken many steps to save energy and to be a green business. We’ve been recycling for 20 years, compost our food waste, and burn used vegetable oil in the diesel truck. Two years ago we installed LED and highly efficient modern fluorescent lighting. We have brushless fans in our coolers and do regular cooler gasket maintenance. Low-flow toilets and faucet aerators, as well as a highly efficient propane furnace, add to these green improvements. The bottom line for us is that they save us money. It makes good business sense to be smart and save energy.”

Frank Hanes of the Inn at Manchester added, “We support all efforts that create opportunities for sustainable alternative energy options. It’s forward thinking. Utilizing local surplus power from the sun helps us lessen the footprint that The Inn at Manchester leaves on the planet that’s important to everyone here.”

Bistro Henry’s system is connected to the grid through a net-metering agreement with Green Mountain Power. Excess energy is sent to the grid during peak production periods. The restaurant draws power from the grid as needed. Green Mountain Power credits full retail value for energy sent to the grid plus 6¢/kWh.

The innovative system was designed, built, and installed by Solar Pro of Arlington, VT and AllEarth Renewables of Williston, VT. Solar Pro has installed over 75 solar systems in southern Vermont. Karen Lee of Solar Pro commented, “The Bistro Henry solar tracker project is an exciting project for us. Solar Pro is proud to be a part of their Green Success Story. We’re pleased to be able to offer our customers a highly innovative product, manufactured in Vermont, that will provide energy savings from the sun.”

The highly innovative AllSun Tracker system is manufactured by AllEarth Renewables in Williston. They have installed over 1,600 systems over the past four years. Bistro Henry can be contacted at (802) 362-4982 or by visiting www.bistrohenry.com.


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SOLAR NEWS FOR THE SOLAR CAPITAL RUTLAND, VT

2014 brings Rutland closer to their designated goal to become the Solar Capital of the Northeast. A rooftop solar farm and a new Solar Center totally 240kW of additional solar commissioned in January!

By N.R. Mallery

On Tuesday, January 21st, 2014, Green Mountain Power commissioned Rutland’s newest solar farm, which is located at the College of Saint Joseph. The 98.28kW project at the CSJ is a fully ballasted roof mount solar photovoltaic system that is atop the college gymnasium. Positive Energy won the competitive GMP bid to design and install the system.

It is likely one of the largest rooftop systems in the Rutland area if not beyond. The project employs US-assembled SolarWorld modules, and a single Solectria inverter that is mounted at the ground level. The installation of the array was completed in under a week, and total construction of the project was wrapped up in just over 2 weeks. Khanti Monroe, VP of Solar Operations for Positive Energy commented, “Working with CSJ and GMP was a real pleasure, and a model example for how to replicate these types of projects going forward.” The project also includes an interactive digital display that allows visitors to see the output and environmental benefits of the project in real time.

This project is an interesting partnership with the CSJ and Green Mountain Power. Green Mountain Power will own the project and lease the rooftop from the college. Positive Energy, who installed the rooftop solar farm, is from Middle Granville, NY. They have been involved with some of the other large solar farm installations that are also connected to the Solar Capital project.

Adding to efforts to make Rutland the solar capital of New England, the Solar Center at Rutland Regional Medical Center went on-line on January 14, 2014. The ceremony was held in the pouring rain. Philip Allen of SameSun Solar, who built the Solar Center, pointed out that “Steve Costello made an excellent point at the ceremony when he was able to show that the array was producing nicely even in this terrible weather!” The 140.4kW solar farm was built through collaboration between Green Mountain Power and Rutland Regional Medical Center. It showcases a touch-screen production monitor, a walking path and educational materials for visitors. Visitors to Green Mountain Power’s downtown Energy Innovation Center can also track the production of the new solar farm on a digital display, which shows how much energy is produced, the amount of coal required to produce the same amount of energy, and related data. “The Solar Center at Rutland Regional is already making an impact, demonstrating to our employees, patients and visitors that we are committed to environmental sustainability and economic development in the region,” President Thomas Huebner said at the ceremony marking the project’s completion. “We are proud to be contributing to Rutland’s revitalization, and hope this first project at the medical center is a precursor to other projects.”

“Rutland Regional proved to be a perfect partner on this project,” said Mary Powell, president and CEO of GMP. “Medical center staff were highly engaged and easy to work with. The project will help meet local peak loads, produce energy close to where it is consumed, reduce our carbon footprint, and help build the local economy. Projects like this are supporting new local jobs and business development in the Rutland area.”

“It’s a meaningful project, fitting in beautifully with the landscape and surrounding buildings,” said Philip Allen, who owns Same Sun with his wife Marlene. She added, “It’s exciting to be a part of the new solar economy in Rutland.”

Positive Energy won the competitive GMP bid to design and install the solar farm under a 25-year lease agreement with Rutland Regional, will credit the hospital for 10% of the project’s output. The remaining energy will be delivered to other local GMP customers.

These projects are part of GMP’s ongoing work to make Rutland the solar capital of New England, with the highest solar capacity per capita of any city in New England. The effort supports Vermont’s goals to substantially expand renewable generation, and GMP’s commitment to support new economic development in Rutland.


GET MORE ENERGY FROM YOUR SOLAR IN THE WINTER

By N.R. Mallery

So, you’ve invested in a solar system. Why? To be able to produce clean renewable energy, save on your energy bills, personal energy independence, and you might even have considered the future of personal energy independence, and you might even have considered the future of the planet in your mix of reasons.

Here comes winter, with snow and ice now covering our solar panels. There goes your energy production — until the wind and sunshine come along, eventually melting the snow or blowing it off — if you’re lucky.

Waiting for Mother Nature’s help doesn’t always work. Is there another option? My own manually adjustable racking system takes 10 to 15 minutes to change the angles of all three pole-mounted rakes. Since the goal is to produce as much energy as possible from the resulting solar gain, we adjust the racks to accommodate for the winter angle of the sun. It also encourages the snow to slide off. But, most often, the snow still sticks.

I am off-grid, very aware of and reliant on how much energy the solar system produces. When the snow stops, you can bet that I am out there clearing the snow off the solar panels.

In the past I retrofitted a foam broom that only came with a pole long enough to clear a vehicle off. We replaced it with a longer wooden pole, but it was still a struggle to reach the very top of all the solar panels. Though that setup worked ok, it was definitely limited. I recently discovered a better solution that I recommend to anyone who has invested in solar: the SnoPro Brum from RoofRack.com. It is manufactured in the USA and is made for cleaning off solar panels! The durable polyethylene foam is rugged enough to tackle snow and soft enough to not harm your solar panels or roof. The dark part of the foam head is softer foam and under that is denser foam with a hard red plastic center into which the telescoping pole is threaded.

The lightweight telescoping pole reaches to a manageable 24-foot length. Now I can also reach the solar hot water panels on my roof, too! The company does offer a German-made pole that reaches up to 30 feet. Those Germans and their solar do it again!

There are more attachments available such as an angle adapter that could be used when additional down-force is necessary or to raise the bar up from the head on a shallow pitch roof or system. The same pole can also accommodate a roof rake attachment, squeegee and even one to help you put up those LED lights on tall Christmas trees.

The instructions for using the SnoPro Brum suggest that you move the snow off the solar panels rather than pulling it all down. Because the pole threads into the center of the head you can both push or pull snow off.

We all want to produce as much power from our solar investment as possible. Isn’t it a good idea to take the time to remove the snow and accomplish just that? I personally think it is well worth the little bit of inconvenience. While there are some installations that are not set up for snow removal, most solar-powered homeowners and businesses in the northern part of the USA might want to consider its value. You can find the SnoPro Brum at roofrake.com or 734-560-7153.
SOLAR PHOTOVOLTAICS
AN (ALMOST) NEW SOLAR INSTALLER

By GET staff

The Sherwin Solar Store is a new solar installer in Essex Junction, Vermont. Or perhaps we should say it is “almost new.” The store’s background can be traced back seventy years, to the opening of Sherwin Electric Company, an organization that proclaims itself “a proud union contractor since 1943.”

Starting with plenty of experience with electricity gave the store a head start on the work it set out to do. For one thing, it meant a staff of professionals was already on board. As a member of the USA Solar Store network, Sherwin was able to get support and experience from a large number of other installers and training. Moving into solar installations was a natural move.

Since the beginning of the summer of 2013, Sherwin Solar Store has made a series of interesting and very different installations, each with its own need for attention to design details.

One job was a 1kW system installed to offset some of the cost of a pool pump running through the summer. Four SolarWorld 250-watt panels were installed on the pool shed, with power going to an Enphase microinverter. The customer can track production online with the Enphase Enlighten communications system.

Another small system has a 1.5 kW array at an off-grid hunting camp. Six Suniva panels supply power to a small bank of four batteries, along with a Magnum Inverter-Charger.

A 2.25 kW system with battery backup was installed in Morristown. The Suniva panels are tied with a Schneider/Xantrex XW inverter-charger, a Midnite Solar Charge controller, and eight Full River AGM batteries. The system is built to be expanded, with an oversized inverter, for future changes when the utility allows net metering. The system’s battery backup system required creating a critical-loads panel for the off-grid system.

Another example is a 4.5 kW grid-tied system in Craftsbury, installed in December. It has a Kaco Blueplanet inverter and Canadian Solar panels.

Sherwin Solar’s store manager, Danielle Bombardier, is working toward becoming NABCEP-certified and hopes to help make the store more accessible to the public. She wants to be able to meet a customer’s needs whether it is for design assistance, a purchase of material from a local store, installation assistance, or all three. The store has a pool of qualified electricians, and apprentices through the local IBEW’s apprenticeship program, which includes solar training.

The Sherwin Solar Store is located at 7A Morse Drive in Essex Junction, VT. Give Danielle a call at 802-316-6780.

another example is a 4.5 kW grid-tied system in Craftsbury, installed in December.

SOLAR: 2013 AND 2014 SHOW DRAMATIC INCREASES

The rate of expansion of solar power is astonishing. The past couple issues of Green Energy Times reported the amount of new solar capacity in Massachusetts, New Hampshire, and Vermont.

We canvassed a number of installers in the area and got responses from five of them, Solar pro, All Earth Renewables, Revision Energy, Sherwin Solar, and Clean Energy Collective. Growth from 2012 to 2013 averaged 15%, ranging from a marginal decline to 100% growth, depending on such factors as changes in state supports.

Projection for growth between 2013 and 2014, however, is dramatic. All Earth Renewables expects to grow from 647 kW installed in 2013 to 754 kW in 2014, in Maine, New Hampshire and Vermont. Clean Energy Collective expects to grow from 144 kW to 4386 installed in Massachusetts and Vermont. Combined, the five companies project growth of 335% this year.

We received a couple of really good comments from the installers as well. Solar Pro’s response said, “The biggest sources of carbon emissions in Vermont come from oil and propane space heaters and automobile tail pipes. Instead of using oil and propane to heat our buildings, Vermonters should install efficient ground- or air-source heat pumps, powered by electricity from solar panels. We should also drive hybrid or electric cars that could be charged with power from solar panels.”

The response from Revision Energy included, “If every municipality in Maine dedicated just 25 acres of land to solar PV generation, the state could power 100% of its energy needs (transportation, homes, heating + electricity, AND manufacturing) from solar!”
A PERFECT STORM IS COMING
YOU CAN BE BLOWN ABOUT, OR IT CAN BE SMOOTH SAILING – IT IS ENTIRELY UP TO YOU.

By George Harvey

A perfect storm is coming to the fossil fuel industry and those electric utilities dependent on it. Consider the signs:

Fossil fuels are facing increasingly strong competition in a contracting market.

Renewables: Investments in renewable power have been rising. Investments in fossil fuels have been falling. The two were first equal in 2010, a fact that became clear when data was analyzed in 2011. Renewables are still a small part of the market, but they are real, effective competition for new investment. In a three-month period in 2013, 99% or more of all new commercial electric capacity put on the grid was from renewables. Efficiency: The thing no one noticed until data on efficiency was analyzed until 2013 was that investments in efficiency were as high as investments in fossil fuels in 2010. This explains why, even though both the population and productivity are increasing, the energy market is contracting.

Fossil fuels are seeing customers turn into competitors.

High electric rates and low costs of renewables mean it is now possible for ordinary folk to produce their own power less expensively than buying it. This includes cost of financing. Electric generating companies are losing residential customers. As renewables have become less expensive, big businesses have come to know it is less expensive to make their own power than to buy it, and whatever excess they have to make is sold. Electric generating companies are getting competition from former large customers. The list of such companies includes Google, Apple, Walmart, IKEA, Staples, Coca-Cola, and many more.

Fossil fuels are seeing increasing costs, while their competitors’ costs decline.

The costs of solar power have declined to below $3 per watt, for commercial installation. There is hope that they will decline to below $1 per watt by 2020. Costs of windpower are also declining rapidly. Costs of oil and gas are not stable. “Fracked” fields are showing declining productivity even though more and more wells are drilled. In some cases, productivity is declining at rates of nearly 50% per year. Natural gas costs are currently low, but over all are only likely to go up.

Also, continued use of fossil fuels requires ever-increasing controls of emissions. This is a problem renewables do not have to face. By comparison, renewables do not have fuel demands and are not subject to fluctuations in the fuel market.

Fossil fuels are having more trouble getting financing; at the same time, renewables are getting funding more easily.

Since wind and solar power do not depend on fuel, it is possible to calculate their costs rather closely for very long periods. Bankers have become aware of this and other benefits. They are increasingly willing to finance renewables.

By contrast, such large financial institutions as the World Bank, European Investment Bank, and the European Bank for Reconstruction and Development are no longer willing to finance coal-based operations.

The old idea about intermittent and variable power from solar and wind are turning out not to be valid.

Not long ago, some proponents of big power plants were saying that it would not be possible to run a grid that was more than 20% powered by solar and wind. This has turned out to be completely wrong in the real world, where some countries are already normally powered by over 40% renewables already. Some have even been occasionally powered 100% by wind.

Traditional forms of power take many hours to several days to get up to speed, so they have to provide a guarded supply all night, selling power at low prices, to take advantage of the high prices of high demand periods during daytime.

Solar power can meet the daytime demand loads, eliminating high profit periods for fossil fuels. And when the sun is not shining, the wind is usually blowing. They make it much harder for old-style plants to make money.

Windpower is getting more efficient.

The output of wind turbines is getting less intermittent and variable. The capacity factor, a measure of reliability of output, is approaching, and in some circumstances even exceeding, that of hydroelectricity and traditional gas plants.

“Smart grids,” with resources combined and controlled by computers, can match grid demand with the correct amount of energy production. It turns out that not only are renewables capable of powering the grid, they may do it better than fossil fuels and nuclear did.

Political and financial pressure against fossil fuels and nuclear is increasing, and with compelling reasons for action soon.

The high cost of fossil fuel subsidies has become clear. The worldwide cost is calculated at over $545 billion each year by the UN. Eliminate that cost, and it is possible to finance the answer to global warming, which has the added benefits of creating jobs, keeping energy money within a country, and providing energy security. Nations are taking note.

The political pressures being brought to bear by fossil fuel companies to get their way are being matched by other, greater pressures to prevent them from doing so. Large companies have begun to notice the high costs of global warming. Major investment organizations, including retirement and mutual funds, with assets valued in the trillions of dollars, are demanding that fossil fuel producers explain how they intend to sustain the time of global warming.

Even in the transportation sector, fossil fuels are set to lose ground.

Prices of electric vehicles and batteries are declining rapidly. Volkswagen says electric cars will cost less than traditional gas-powered vehicles within three years. Including the government incentives in the US, they already do. And, they can be powered by an owner’s solar panels.

Our conclusion: Forget fossil fuels; invest in renewable power.

A perfect storm is coming to the fossil fuel industry and those electric utilities dependent on it. Consider the signs:

Fossil fuels are facing increasingly strong competition in a contracting market.

Renewables: Investments in renewable power have been rising. Investments in fossil fuels have been falling. The two were first equal in 2010, a fact that became clear when data was analyzed in 2011. Renewables are still a small part of the market, but they are real, effective competition for new investment. In a three-month period in 2013, 99% or more of all new commercial electric capacity put on the grid was from renewables.

Efficiency: The thing no one noticed until data on efficiency was analyzed until 2013 was that investments in efficiency were as high as investments in fossil fuels in 2010. This explains why, even though both the population and productivity are increasing, the energy market is contracting.

Fossil fuels are seeing customers turn into competitors.

High electric rates and low costs of renewables mean it is now possible for ordinary folk to produce their own power less expensively than buying it. This includes cost of financing. Electric generating companies are losing residential customers. As renewables have become less expensive, big businesses have come to know it is less expensive to make their own power than to buy it, and whatever excess they have to make is sold. Electric generating companies are getting competition from former large customers. The list of such companies includes Google, Apple, Walmart, IKEA, Staples, Coca-Cola, and many more.

Fossil fuels are seeing increasing costs, while their competitors’ costs decline.

The costs of solar power have declined to below $3 per watt, for commercial installation. There is hope that they will decline to below $1 per watt by 2020. Costs of windpower are also declining rapidly. Costs of oil and gas are not stable. “Fracked” fields are showing declining productivity even though more and more wells are drilled. In some cases, productivity is declining at rates of nearly 50% per year. Natural gas costs are currently low, but over all are only likely to go up.

Also, continued use of fossil fuels requires ever-increasing controls of emissions. This is a problem renewables do not have to face. By comparison, renewables do not have fuel demands and are not subject to fluctuations in the fuel market.

Fossil fuels are having more trouble getting financing; at the same time, renewables are getting funding more easily.

Since wind and solar power do not depend on fuel, it is possible to calculate their costs rather closely for very long periods. Bankers have become aware of this and other benefits. They are increasingly willing to finance renewables.

By contrast, such large financial institutions as the World Bank, European Investment Bank, and the European Bank for Reconstruction and Development are no longer willing to finance coal-based operations.

The old idea about intermittent and variable power from solar and wind are turning out not to be valid.

Not long ago, some proponents of big power plants were saying that it would not be possible to run a grid that was more than 20% powered by solar and wind. This has turned out to be completely wrong in the real world, where some countries are already normally powered by over 40% renewables already. Some have even been occasionally powered 100% by wind.

Traditional forms of power take many hours to several days to get up to speed, so they have to provide a guarded supply all night, selling power at low prices, to take advantage of the high prices of high demand periods during daytime.

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Earlier studies have, in general, shown what it was like to have a wind farm nearby. What people had been able to experience from before the time the wind farm was first proposed, to the point that they can donate money leaves the state. Every installation of a coming wind farm is a very slight drop in property values. As the process of permitting, construction, and operation of the wind farm progresses, the property value typically recovers. In the end, the evidence, though not considered statistically significant, is that there is a slight increase in property values from nearby wind installations.

An increase in property values should not come as a surprise. Earlier studies have, in general, shown similar results. We have seen at least ten studies that were carefully done by competent, neutral organizations. Only one of these shows a very slight drop in property values, though the cause of this was not clearly associated with wind turbines. Seven others show no appreciable change. Three line maintenance, and hydroelectric production. These are not listed because they confuse the issue with such questions as whether an egg should be counted as a bird. Apart from these, however, all causes of importance equal to or greater than wind turbines are listed.

Why, you might ask, do we hear so much about wind turbines killing birds, if they don’t even kill as many as gill fishing nets? Also, are the figures possibly biased in favor of wind?

To answer the second question first, we can doubt that the wildlife experts in Canada would misrepresent facts for the sake of people who might make money on running wind farms or selling wind turbines. They have no reason to do so. As to the first question, we might answer that people who talk about wind-related bird deaths also talk about wind farms doing just about all of the following: destroying property values, raising taxes, making people sick with Wind Turbine Syndrome, failing to provide income for the investors, destroying aquifers, destroying natural habitats, and even failing to replace the energy required to make the wind turbines. Some of these arguments are hysterical, and some are pathetically silly, but all have been soundly refuted, over and over, by peer-reviewed studies, and none seems to have been supported by articles that follow strict scientific standards.

So why would windpower be under attack? It’s possibly because of the following.

First, windpower represents a financial threat to die-hard fossil fuel corporations. Second, there are people who can make a lot of money benefiting the fossil fuel corporations by promoting hysteria. Third, there are people who become hysterical, to the point that they can donate time, money, and passion to a cause that only profits a select few, at the expense of the rest of the world.

Cranes flying north past wind turbines in the background. Photo by Erell.
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 projects, the ITC can be increased to 35%. Incentives are also available for combined heat and power, and the ITC is 10% of expenditures.

USDA Rural Development Program

USDA Rural Development Program - Rural Energy for America (REA)
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/REAPขนาดลงท้ายไปที่ www.rurdev.usda.gov/REAP

VERMONT

Clean Energy Development Fund
The Thel Small Scale RE Incentive Program, administered by Renewable Energy Resource Center (RERC), provides funds to help defray the costs of new solatl, geothermal, wind, and micro-hydro systems.

Solar Incentives – based on rated capacity of system

http://rerc-vt.org/incentives/index.html
http://www.dsireusa.org/incentives

residential (including leasing)= $0.25/ Watt up to 10kW for PV; $1.50/100kWh/Day up to 200kWh for ShW.
commercial/industrial = $1.50/100kWh/Day up to 1100kWh/Day for ShW.

Special customer = $1.25/Watt up to 10kW. $3.00/100kWh/Day up to 1500 kWh/Day for ShW. **Group net-metered projects are only eligible for residential customers with residential meters.
PV and ShW Efficiency Adder - adder is calculated separately and added to standard incentive subject to customer caps (eligibility requirements apply, contact RERC)
residential = $0.15/Watt for PV; $0.50/100kWh/Day for ShW. Capted at a cumulative $350, residential customers; $450, commercial/industrial/special customer = $0.15/W; $0.50/100kWh/Day up to a cumulative $450 per customer

Micro-Hydro:
residential/commercial/industrial = $1.75/3/gal/minute Capted at $8750 special = $3.50/3/gal/minute Capted at $17500 or 50% of installed cost. **Special customer category limited to municipalities, non-profit housing authorities, public schools. All incentives are subject to availability and may change.

Visit 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. Any unused tax credit may not be carried forward.

EFFICIENCY VERMONT

Lighting (must be ENERGY STAR)
CFLs - select ENERGY STAR qualified spiral and specialty CFLs are just $9.97 at participating retailers
LEDs – bulbs with special pricing/ coupons at register while supplies last at participating retailers

Home Efficiency Improvements
improvements: air sealing, insulation and heating system upgrades - up to $12,100 in incentives - using participating* contractors
Appliances (must be ENERGY STAR)
Dehumidifiers - $25 mail-in rebate
Clothes Washers - $40 rebate for CEE Tier 3 qualifying models, $75 rebate for ENERGY STAR Most Efficient Refrigerators - $40 rebate for CEE Tier 2 Refrigerators, $75 for CEE Tier 3 & ENERGY STAR Most Efficient Working second refrigerators or freezers are potentially eligible to be picked up. $50 incentive to retire old units.
Clothes Dryer – rebate for replace electric with natural gas (contact EV)

Heating/ Cooling

heating & cooling systems, see EV*
energy efficient central AC and furnace fan motor - $100 mail-in rebate
central wood pellet boilers (excluding outside wood systems) - $1,000 (See announcement on page 25)

Residential New Construction

enroll in Residential New Construction Service – up to $1,500 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 may also receive additional incentives (contact EV)

Other Opportunities To Save
Advanced Power Strips – special pricing/ coupons at register at participating retailers
Pool Pump (2-speed variable speed) - $200 mail-in rebate
Meter Loan – borrow “Watts Up” meter to measure the electric consumption of your appliances.

New Hampshire Renewable Energy Incentives Offered Through the NH Public Utilities Commission

Commercial Solar Rebate Program
Program open to non-profits, businesses, public entities and other non-residential entities

Residential Solar PV

15% of the project cost up to $5,000 for Geothermal Heat Pumps.
$500-$3000 per system based on SEER rating for Ductless Mini-Split Heat Pumps.

Solar Thermal

is 25% of the project cost up to $10,000.
$500-$3000 per system based on SEER rating for Hybrid Central Heat Pumps.

$500 per installed kW for residential (including leasing), up to $25,000 based on SEER ratings for Commercial ground or air source heat pumps and ERVs.

NH ENERGY STAR Homes

Incentives for builders of new homes who meet ENERGY STAR guidelines.

New Hampshire

Grassroots Environmental Fund

Modest grants are available for community-based environmental work in schools, daycares, and public libraries.

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

have an annual budget up to $100,000

“Seeded” grants of $250-$1,000 and “Grow” grants of $1,000-$3,500

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

New England

Grassroots Environmental Fund

Modest grants are available for community-based environmental work in schools, daycares, and public libraries.

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

have an annual budget up to $100,000

“Seeded” grants of $250-$1,000 and “Grow” grants of $1,000-$3,500

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

Residential Solar Water Heating Rebate Program

$1500 - $1900 per system based on annual system output
Contact barbara.bernstein@puc.nh.gov

Wood Pellet Boiler or Furnace

30% of installed system up to $2,500 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

NH ENERGY STAR Homes

Incentives for builders of new homes who meet ENERGY STAR guidelines.

www.nh.saves.com

NH Home Performance with ENERGY STAR

Sponsored by all NH electric and natural gas utilities in partnership with the U.S. Dept. of Energy. Fuel-blind eligibility using the Home Heating Index (Btu 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 of comprehensive energy audits. $200 ($100 rebated if improvements installed), and 50% instant rebate for eligible weatherization improvements up to a $4,000.

Contact barbara.bernstein@puc.nh.gov

www.nh.saves.com/residential.html for more information and an online Home Heating Index calculator

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.

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.
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/home.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 smart strips ($10). Visit www.nhsaves.com/residential/es_appliance.html 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 styles that are hard to find to 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.

Other NH Electric Utility Programs

See also individual utilities for additional programs and variations. NH electric utilities may offer low or no interest-in-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


**Commonwealth Solar Hot Water (SHW) Programs**

Offered through BEACON, the Solar Grid, NSTAR, Uniteil (Fitchburg Gas and Electric), WMWCO or a participating Municipal Light Plant community.

- Residential Rebate: $25 per collector X the SRCC thermal performance rating of the collectors (pl refer to kBTU/panel/day for Category C, Mildly Cloudy climates)
- Metrics for typical SHW system for 2-4 people, 2-panel roof-mounted plus 80 gal solar tank: materials/installation costs = $10,000, MA CEC residential rebate = $2400 including • Adder for moderate home value or for moderate income, MA State Tax Credit (use only once) = $1000, Federal Tax Credit (30% system cost) = $3000, Net Cost = $3600


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 minus the MA CEC rebate. Apply through requiring the MassSave Energy Audit.

**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 Western Mass Electric, National Grid, Berkshire Gas, NSTAR, Uniteil and Cape Light Compact Visit www.massave.com/residential/heating-and-cooling/offers/heat-loan-program Please call 866-527-7283 to schedule a free home energy assessment.

Commonwealth Solar PV Programs

www.masscec.com

Commonwealth Solar II provides rebates for homeowners and businesses in Massachusetts who install solar photovoltaics (PV). Rebates are granted through a non-competitive application process for the installation of photovoltaic (PV) projects by professional, licensed contractors at residential, commercial, industrial, institutional and public facilities. In addition to the basic incentive (.40/W), further incentives (“adders”) are available for installations using components manufactured in Massachusetts (.05/W), for individuals with moderate income or home values (.40/W), and for those who are building in the wake of a natural disaster (1.00/W).

For all systems, rebates are calculated by multiplying the per watt incentive (base incentive plus adders) times the nameplate capacity of the system, up to 5 kilowatts (kW); projects are eligible for rebates only if their total capacity is under 15kW. Further eligibility requirements apply, and potential rebate recipients should read the full program documentation.

Visit www.masscec.com/solicitations/commonwealth-solar-ii-block-16

**DEPT OF ENERGY RESOURCES**

- Solar renewable-energy credits (SRECs) associated with system generation belong to the system owners and may be sold via the Department of Energy Resources (DOER) SREC program. Note: appropriate, approved tracking must be utilized in order to qualify to sell SRECs. 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 solar hw or pv systems.
- There is no increase in property tax assessment for residential hw or pv systems for 20 yrs.

**CARBON TAX: WHY IT IS NECESSARY, AND WHY IT IS FAIR**

By George Harvey

The US EPA has estimated the social cost of letting carbon dioxide escape into the atmosphere at $12 to $116 per ton. Since this can be hard to understand, it may need an explanation.

The social costs of carbon emissions are all around us. Many of them can be seen in health problems requiring costly medical attention, such as asthma, respiratory distress, and a number of other health issues relating to fossil fuel pollution. Aside from health problems, there are also climate change, damage to property, ocean acidification, and a long list of other issues.

Many people find it hard to envision a ton of carbon dioxide. Burning a gallon of gasoline in a car engine releases about twenty pounds of carbon dioxide. This may defy logic for some people, because a gallon of gasoline weighs less than seven pounds, so they ask how it could produce twenty pounds of gas. In being burned, the carbon in the gasoline combines with oxygen from the air, and the oxygen provides almost three quarters of the weight of carbon dioxide. Because a gallon of gasoline produces twenty pounds of carbon dioxide, the $12 to $116 per ton social cost of carbon dioxide equates to $0.12 to $1.16 per gallon of gasoline.

The social cost of gasoline is not taxed or paid at the pump. Neither the oil industry nor the consumer is charged a fee. Nevertheless, each gallon of gas a person burns means doing $0.12 to $1.16 worth of damage. Other fossil fuels have their own costs, but they are similar or worse in effect.

Perhaps we could think of using fossil fuels as producing charges against a Global Sickness Account. If a car gets twenty miles to a gallon of gas, it may be charging the consumer $0.12 to $1.16 per mile. Actually, the issue is worse than that. Fossil fuels spill a long list of pollutants into the air: sulfur compounds, nitrates, nitrates and radon. In the case of coal, the list also includes mercury, lead, and thorium. Here in New England, we have streams and rivers whose fish should not be eaten because they contain excessive mercury from coal-burning power plants in Ohio, Michigan, Pennsylvania, and other upwind states. We did not cause the pollution, but it is ours to deal with. In the case of mercury, we have no practical way even to do that, so it is likely to hang around for centuries.

And here is the place where we need to be fair; Fossil fuels create charges against the Global Sickness Account, but the costs are born entirely by victims, including many who do not benefit from fossil fuel use at all. Thus the $12 to $116 do not reflect include nearly all forms of wildlife and a large percentage of the world’s poor. Fairness means those who created the costs that the one who foot the bill, and the victims get some relief.

A carbon tax will help make the pollutants bear their fair share of the costs. And it can help finance the cure.

As the February issue of Green Energy Times comes out mid-month, our legislators are meeting. Does anything come to mind?

**CONGRESS SHOULD PUT A PRICE ON CARBON POLLUTION**

By Sen. Bernie Sanders (V-VT) and Sen. Barbara Boxer (D-Calif.)

More than 700 companies that drive the U.S. economy - including Microsoft, Owens Corning, General Motors, the Portland Trail Blazers and candymaker Mars - have signed a declaration calling for national action on climate change. This is a remarkable shift in how some of the nation’s biggest corporations view the threat posed by climate change. Policymakers should take notice.

The nation’s five biggest oil giants are among a smaller set of companies that had strongly resisted proposals to address climate change but now are incorporating its practical impact into their strategic planning. According to a new report by the environmental data company CDP, more than two dozen of the nation’s leading corporations are planning for the future with the expectation that carbon emissions fees will be one of the steps the

**BLACK MATERIAL: REVERSE BLACK**

Coal-fired Gavin Power Plant on the Ohio River
GEOTHERMAL + SOLAR = EFFICIENCY

By George Harvey

When Don and Judy Jordan decided to build a house, they wanted to share it with Judy’s parents, who are in their mid-80s. This meant addressing some unusual needs for warmth, as they had spent twenty years in Florida, and special consideration for potential special needs. Given four adults and a potential for visiting grandchildren, they allowed 3325 square feet of space. These issues meant making some careful choices on how to achieve efficiency and comfort without breaking the bank.

They contacted Prudent Living, a division of Biebel Builders, of Windsor, Vermont, to help them with the project. This choice gave them some guidance with some very technical issues. They did not decide to be fancy and go for LEED certification, or even to be entirely free of fossil fuels. Nevertheless, they achieved some very impressive results, in terms of green performance, because they were trying to get comfort, warmth, and economy, goals that can be achieved through green means.

Insulation and sealing are, of course, essential. Even if your heating is great, it does no good if you are using it to heat the great outdoors. R-60 insulation was specified for the ceiling, and above-grade walls were R-40 and R-30. Below grade walls were specified at R-20, with insulation under the slab at R-10. The house was buttoned up, and GDS Associates of Manchester, New Hampshire, tested for infiltration.

All told, the house would get a HERS Index of 42, if it were rated without consideration for renewable energy generating capacity. This means it uses only 42% of the energy needed to power a typical new house of the same size.

Given a good start on insulation and sealing, the Jordan’s went for a ground-source heat pump, or geothermal heat, to provide both house heating and hot water. This provides heat at just about the lowest possible price heating in a house that is not actually passive solar. It also makes possible use of the same equipment for cooling, as needed.

One result of the choice of ground-source heat pump is that the overall cost of heat has dropped below the cost of lighting. This is despite the fact that all the lighting is Energy Star compliant. Offsetting the electricity load, the Jordans opted to have solar PVs generating about 70% of the power they need. This reduces their HERS Index to 12, meaning that their net usage is only about 12% of what might be normally be expected. Adding in service charges and a very small amount of propane used for cooking and drying clothes, their cost for 2013 was estimated at less than $1000 for all power and fuel, and their carbon emissions were a good deal less than half a ton.

The Jordans’ house got a confirmed Energy Star certificate of “Five Stars+”.

3325 s.f. of efficiency include geothermal & a super efficient building envelope. Photo credit Tim Biebel

SAVE MONEY AND ENERGY WITH “SMART” THERMOSTATS

By Roddy Scheer and Doug Moss

Spending $200 or more to replace that older, still functioning thermostat with a new whiz-bang “smart” variety might seem like a waste of money, but it can be one of the best small investments a homeowner can make, given the potential for energy and cost savings down the line. The coolest of the bunch of new smart thermostats, the Nest, was created by former Apple employees who had been instrumental in designing the original iPod and iPhone years earlier. This simple-looking round thermostat is reminiscent of old-school thermostats that one would manually adjust by turning the temperature dial. But the auto-awake feature that turns on the bright blue digital display when someone walks nearby gives the Nest away as an ultra-modern piece of high-tech gadgetry.

The Nest’s software “learns” the habits in a given space by logging when inhabitants tend to be home and awake and noting when they tend to turn up or down the heat—and then sets a heating and cooling schedule accordingly. Owners can also program the Nest, which connects to the Internet via Wi-Fi, to heat or cool the house at a schedule or go into “away” mode from any web browser or smart phone.

While the Nest is likely the best known smart thermostat available—especially since Google acquired the company behind it early 2014—several other manufacturers (including Honeywell, ecobee, Hunter, Radio Thermostat, Trane and Lux) have Wi-Fi-enabled smart thermostats available now as well.

While only some of them have the auto-sensing and learning capabilities of the Nest, those without that feature also cost less. And merely programming in a weekly schedule to any smart thermostat will be the main source of cost and energy savings. People who were diligent about turning their old thermostats up and down throughout the day might not see any substantial savings with a smart thermostat, but most of us aren’t so diligent—especially when it comes to turning the heat down at night when we are sleeping.

Many smart thermostat owners report savings of between $10 and $30 per month on their heating and cooling bills—and research has shown that such an upgrade can save upwards of 10 percent of the total energy consumed by a given household. Smart thermostats range in price from $50 to $250, so upgrading could pay for itself within a year or two at most, with long-term savings racking up month-by-month after that. Many utilities now offer free or discounted.

Cont. on page 19
Heat pumps seem to be in the news recently. In April, Efficiency Vermont launched a new program promoting them and Green Mountain Power recently launched a heat pump rental program that appears to be wildly successful. They expected to hear from about 200 customers but instead received inquiries from more than 600. What's up?

Members of Building for Social Responsibility are intrigued with the technology and are excited to see heat pumps designed for Vermont’s climate now available at reasonable costs. Besides biomass, we now have a fossil fuel alternative that can automatically heat (and cool) our homes at about half the operating cost of oil or propane. And since heat pumps run off electricity, we can now deliver zero net-energy heating and cooling systems by adding PV panels to offset the heat pump load. If all this is so good, what’s the catch? Is this another of those too-good-to-be-true technologies that will be gone after an initial flash in the pan?

Actually, heat pumps have been around for decades and are the primary means of heating and cooling buildings in most of the world outside of North America. The technology is the same as that used in refrigerators to concentrate heat and move it from one place to another. With a refrigerator, it works to gather up the heat in the food storage area and then dump it into the kitchen. With today’s heat pumps, in winter they concentrate heat from outside (even in temperatures below 15 degrees below zero) and then deliver it inside. In the summer they do the opposite to cool the building by moving heat from inside to outside.

While we have been installing “ground-source” heat pumps in the Northeast for decades that are able to move heat between buildings and the ground (or water wells within the ground), they tend to be pricey, typically $20,000 to $40,000 installed. The new “air-source” heat pumps do not require drilling expensive wells or digging long trenches like those that are necessary for the ground-source units, and can be installed for about $4,000 per unit for those systems that work in Vermont’s cold climate. These “cold-climate air-source” heat pumps can provide up to about 20,000 Btu per hour, so you would typically need a few systems for a well-insulated tight Vermont house, provided the layout works to allow heat distribution. For two systems, that’s $8,000; not bad for a heating and cooling system that cuts oil bills in half!

If you want to know more about which units work best in Vermont’s winters and what incentives are available for installing cold climate heat pumps in existing homes to displace oil and propane, take a look at http://www.efficiencyvermont.com/for_my_home/ways-to-save-and-rebates/energy_improvements_for_your_home/Cold-climate-heat-pump/overview.aspx.

Richard Faesy is Co-founder and Principal of Energy Futures Group, Inc. www.energyfuturesgroup.com
Sustainable Sugaring

Solar Sweet Maple Farm

Tom Gadhue had a vision, and it produced his motto, “A green twist on an old Vermont tradition”. He wanted to make maple syrup, and he wanted the farm to have the smallest environmental impact possible. So he and his wife, Rhonda built Solar Sweet Maple Farm to be as sustainable as possible.

He started building his sugarhouse by salvaging the frame of a glassblower’s studio. The sidings of the sugarhouse are insulated with panels, four inches thick. The sugarhouse has a large, south-facing roof, so it could hold as many solar PVs as possible. His 12.5kW array is net-metered, so he can bank electricity credits in the summer for use in the winter. Tom chose a number of energy-saving features as well. The lighting is all done with LEDs. The reverse-osmosis machinery he has removes 80% of the water before the sap is heated, and it is solar-powered. Vacuum pumps pull sap to the building, also powered by the sun. The evaporator is fueled with wood from his own woodlot. So is the hot water and heat for buildings. The evaporator is powered by wood, but with a new twist. It has a wood gasification system that starts with a fire beneath the evaporator, captures unburned flue gases, then adds fresh air to finish burning them, heating the evaporator more. This results in a burn that is as nearly complete and non-polluting as possible.

Heat is reclaimed from the steam as the sap boils. It is used to preheat feedwater for the evaporator. Tom estimates a reduction in the amount of wood needed to boil the sap of over 70%

Solar Sweet Maple Farm has a line of maple products including four different grades of syrup, samples and gift items, maple cream, maple walnuts, and maple balsamic dressing.

The farm is located at 3841 South Lincoln Road Lincoln, Vermont. Their number is 802-453-6063 and the website is solarsweetmaplefarm.com.

Suggested uses for Maple Syrup

- Use on cereal instead of sugar
- Sweetener for yogurt over fruit
- As a topping for ice cream
- Sweetener for coffee or tea
- Added to stir fry or sweet & sour dishes
- Excellent as sweetener in baked goods
- Nice addition for baked winter squash

Guidelines For Cooking with Maple Syrup

To replace sugar with maple syrup in your baking, use 3/4 cup of syrup for every cup of sugar you use.

- Maple syrup is slightly acidic so you may want to add 1/4 to 1/2 tablespoon of baking soda. This is not necessary if you are using recipes with butterscotch, caramel, or milk.
- To replace honey with maple syrup, use the same quantity of syrup instead of honey.
- Reduce the oven temperature by 25^°. Maple syrup can cause more browning than sugar.

Sustainable Sugaring

Solar Sweet Maple Syrup is made in a 5x14 D&G wood-fired gasification evaporator. The wood is harvested from their sugar woods and is used to heat the evaporator and the sugarhouse.

Silloway Maple Farm

Silloway Maple, in Randolph Center Vermont, really does date back to the times of Norman Rockwell. Paul Silloway started it as a dairy farm in 1940 and expanded into maple sugaring in 1942. In those days firewood and sap were gathered with a team of horses, and no fossil fuels were used at all.

Today, the maple operation is managed by Paul Lambert, Paul Silloway’s grandson, with his mother Bette, and David, Lynne, Stuart, and John Silloway. The firewood for the evaporator comes from logging waste, but the amount needed is also reduced from what it was in the old days. Most of the water in the sap is removed before it is even heated up by using reverse osmosis. The reverse osmosis is powered by sunlight from the farm’s solar PV array.

Recently, the farm needed a new building for sugaring. Paul and Bette Lambert decided to put 17.5kW of solar PVs on its roof. The solar system was installed by Integrity LLC of Bethel, Vermont. This provides power for the farm’s maple sugaring with excess going towards the dairy production. The system is grid-tied and net-metered, so summer production helps with winter usage.

When the Vermont Agency of Agriculture started a voluntary sugarhouse certification program, Silloway quickly joined in to get one more seal of approval, cleanliness, and safety.

The farm has about 6100 maple trees and the owners hope to produce 3100 gallons of pure maple syrup. In addition to syrup, they produce maple cream and maple walnuts, peanuts and almonds. Their products are sold at the farm, in retail stores, and through their website. They also have a working dairy with 65 milking Holsteins. They do logging, and sell firewood. Bette Lambert asked that we remind everyone that the Vermont Maple Open House Weekend is March 22 and 23. Silloway Maple Farm will, of course, be participating. She said they will offer maple sugar on snow and homemade doughnuts with syrup. How could anyone pass that by?

Silloway Maple Farm is at 1033 Boudreaux Road, Randolph Center, Vermont. Their number is 802-728-3625.

THE VERMONT MAPLE FESTIVAL
Downtown St. Albans and area buildings on April 25, 26, 27 • www.vtmaplefestival.org
Sylvan’s Mapleland / 1169 Sheldon Rd / St. Albans, VT
Silas Family Farm / 3842 Sheldon Rd / St. Albans, VT
The Maple Guys / 146 Schoolhouse Rd, Lindonborough, NH
(603) 483-3520 • www.mapleguys.com
A family-owned business that has been producing maple syrup since 1989. Maple sugaring supplies and equipment. Award winning Maple Syrup from tax-free southern New Hampshire. From our trees to your table!

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**North Family Maple Farm**

In earlier times, Shaker communities were divided into groups called families, often named after compass points. The North Family Maple Farm occupies land of the North Family of the Shaker community in Canterbury, New Hampshire, settled in 1792.

The farm has been a family-run business since 1950. Today, it is run by Tim, Daimon, and Gemini Meeh and Jill McCullough. In 2011, they won an award as New Hampshire’s outstanding tree farm for 50 years of sustainable forest management.

Starting as a dairy farm, in 1959, it became a school, which eventually moved to its own campus. Farming started again in 1974, and since then, the farm has produced a variety of products. It has had a small retail Jersey dairy, and bred and trained Percheron horses. It has had grain crops, and organic vegetables. It has sold milking lumber.

Now, the farm sells hay, firewood, timber, and maple products, all grown with an eye to sustainability. It has a small wind turbine and 7kW of owner-installed solar PVs. It uses biodiesel and sustainably grown wood for fuel. Unsurprisingly, their maple product is New Hampshire Certified Organic Maple Syrup.

The farm uses reverse osmosis to concentrate the sap. Then a gasification system evaporator removes most of the remaining water. This reduces the amount of firewood needed by 87%.

Their website also provides some very interesting information on the health benefits of maple syrup, including its effects against diabetes and certain common types of cancer. There are links to information sources.

The maple products include maple syrup in various sizes and container types, maple cream, and maple sugar. North Family Farm is in Canterbury, New Hampshire. The number is 603-783-4712, and the website is northfamilyfarm.com.

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**DID YOU KNOW?**

vermontmaple.org

Maple syrup contains an abundant amount of naturally occurring minerals such as calcium, manganese, potassium and magnesium. And like broccoli and bananas, it’s a natural source of beneficial antioxidants.

Antioxidants have been shown to help prevent cancer, support the immune system, lower blood pressure and slow the effects of aging.

Maple syrup is also a better source of some nutrients than apples, eggs or bread. It’s more nutritious than all other common sweeteners, contains one of the lowest calorie levels, and has been shown to have healthful glycemic qualities.

Maple syrup was the original natural sweetener. Native peoples in North America were the first to recognize 100% pure maple syrup as a source of nutrition and energy. Since then, researchers have been documenting that maple syrup has a higher nutritional value than all other common sweeteners. In addition, researchers have found that pure maple syrup contains numerous phenolic compounds, commonly found in plants and in agricultural products such as blueberries, tea, red wine and flax-seed. Some of these compounds may benefit human health in significant ways.

So go ahead and satisfy that sweet tooth with something that not only tastes great...but is naturally good FOR you! 100% Pure and natural Vermont maple syrup...a gift from Mother Nature herself!

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**PEANUT BUTTER MAPLE COOKIES**

_Yields 16 to 24 cookies, depending on size._

- 1/2 cup of butter softened (1 stick)
- 3/4 cup pure Vermont maple syrup
- 1 teaspoon vanilla extract
- 1 egg
- 3 cups peanut butter, preferably natural chunky peanut butter
- 1-3/4 cups flour
- 1/2 teaspoon salt
- 1/2 teaspoon baking soda

_Peanut butter and maple are a natural pairing._

**RECOMMENDED READING:**

**The Sugarmaker’s Companion**

_An Integrated Approach to Producing Syrup from Maple, Birch, and Walnut Trees_ by Michael Farrell, 344 pages, Chelsea Green Publishing, $39.95

The Sugarmaker’s Companion is the comprehensive guide syrup producers have been waiting for. Many unique aspects of this book set it apart from all others. These include sustainable production; health benefits; certification, registration, and grading systems; understory crops; forestry; economics; marketing; business models; and more.

This book is applicable to a wide range of climates and regions, and is sure to prove invaluable for both home-scale and commercial sugarmakers. This is a unique guide to making an integrated sugaring operation, interconnected to the whole-farm system, woodland, and community.

**Maple Sugarin’ in Vermont - A Sweet History**


Relating the history of the “Flavor of Vermont” from the 1600s to the mid-twentieth century, Betty Ann Lockhart introduces readers to the tools of the sugaring trade and the personalities who launched maple sugar to world fame. The Abenakis discovered it, and Thomas Jefferson was an early promoter of its virtues. During the Civil War, maple sugar was cheered as the moral alternative to cane sugar, which was produced by slave labor. Enriched with maple-inspired songs, recipes and legends, Maple Sugarin’ in Vermont illuminates the culture of Vermont maple sugar.

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**PEANUT BUTTER MAPLE COOKIES**

Courtesy of vermontmaple.org

_Yields 16 to 24 cookies, depending on size._

- 1/2 cup of butter softened (1 stick)
- 3/4 cup pure Vermont maple syrup
- 1 teaspoon vanilla extract
- 1 egg
- 3 cups peanut butter, preferably natural chunky peanut butter

1-3/4 cups flour
1/2 teaspoon salt
1/2 teaspoon baking soda

Preheat oven to 375°F. Using mixer, combine butter and syrup until well-mixed and creamy. Add vanilla extract, egg, and peanut butter and beat until well-mixed and creamy.

In a separate bowl, combine flour, salt, and baking soda. Add dry ingredients to the peanut butter mixture in several additions, mixing well before adding more.

Roll tablespoons of the dough into a ball and place on an ungreased baking sheet. This at, if you prefer peanut butter cookies with the a crosshatch pattern, press cookies with a fork to create crosshatch. Bake for 15 minutes and let cool on the sheet for several minutes before transferring to a rack to completely cool. Serve and enjoy!

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**NUTRITIONAL VALUE FOR VARIOUS SWEETENERS**

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SOURCE: Canadian Nutrient File, 2007 (Health Canada) and US Food and Drug Administration Nutrient Database.
METHANE

By George Harvey

Methane is a powerful greenhouse gas, more than twenty times as bad as carbon dioxide. It also stays in the atmosphere for a long time, once released. This means it is better to burn it, even if no net benefit is derived from the heat, than to let it go into the air as it is.

Nevertheless, methane has many uses, and that can make it valuable. It is the main constituent in natural gas, which is rapidly replacing the coal used in the United States. Since methane is much cleaner and releases less carbon dioxide than coal per unit of energy produced, it provides some improvement. This does mean it is perfect, just that it is better than coal.

The bacteria also work on materials in landfills, where they decompose such biomass as waste food, waste paper, and wood. This is why it is very important that landfills be covered to capture the gas coming out. The methane captured this way is used as fuel — or if there is not enough of it for such use, it is burned so carbon dioxide is released instead of methane.

The same kinds of bacteria live in biodigesters, where they decompose agricultural and food waste, or even municipal waste, to produce biogas. Biomethane is usually burned for energy and heat. It turns out to be one of the least expensive sources of electricity we have right now.

Methane can also be synthesized. It is relatively easy to capture carbon dioxide from the emissions of natural gas power plants, and only a bit more difficult to capture it from coal-burning plants. Meanwhile, excess power on the grid, which can be purchased at very low wholesale prices, can be used to make hydrogen. The carbon dioxide and the hydrogen can be combined with catalysis. This requires some heat, which can be captured as waste heat from the power plants, and some pressure, for which we can use more of the low-cost excess power.

Once we use low-priced power to synthesize methane, it is easy to store for use at peak demand times, when the price of power is high. Though the efficiency of the process is lower than that of just using natural gas, it can be more profitable and less polluting than using natural gas all the time.

The process of making methane from carbon dioxide was invented in 1913. It has not been used much as it is expensive compared to the cheap oil that was available in the 20th century. Now, when power is more costly, it is being tested commercially as a power source.

Methane can also be used as a feedstock for the production of a number of important chemicals. A process dating to the 1930s can catalyze methane into any of a variety of chemicals, including propane, butane, octane, and so on. Gasoline, diesel oil, and home heating oil can be made in this way.

One set of products methane can be used to make is plastics. The plastics can be nearly identical drop-in replacements for such materials as polypropylene, polyethylene, or polystyrene. They can be made to be recyclable or biodegradable.

Ultimately, there are two important questions about a supply of methane. First, is it a fossil fuel, or does it come from biological activity that removes carbon from the air? Second, is it released methane, or as some relatively benign product? If it comes from the ground, it will be a greenhouse gas. If it comes from the air, it can have an effect that is neutral at worst, or possibly even beneficial.
LOW ENERGY VENTILATION

Spot Ventilation
Spot ventilation can improve the effectiveness of natural and whole-house ventilation by removing indoor air pollution and moisture at the source. Spot ventilation includes the use of localized exhaust fans, such as those used above kitchen ranges and in bathrooms. ASHRAE recommends intermittent or continuous ventilation rates for bathrooms of 50 or 20 cubic feet per minute and kitchens of 100 or 25 cubic feet per minute, respectively.

Whole-House Ventilation
The decision to use whole-house ventilation is typically motivated by concerns that natural ventilation won’t provide adequate air quality, even with source control by spot ventilation. Whole-house ventilation systems provide controlled, uniform ventilation throughout a house. These systems use one or more fans and duct systems to exhaust stale air and/or supply fresh air to the house.

There are four types of systems:
- Exhaust ventilation systems work by depressurizing the building and are relatively simple and inexpensive to install.
- Supply ventilation systems work by pressurizing the building, and are also relatively simple and inexpensive to install.

Cont. on page 30

BUTTON UP NH
WEATHERIZATION WORKSHOP IS COMING TO PLAINFIELD ELEMENTARY SCHOOL, MERIDEN, NH

On Wednesday, February 19, 2014, the Plainfield Energy Committee will co-sponsor a BUTTON-UP weatherization workshop — at the Plainfield Elementary School on Bonner Rd. in Meriden, NH.

Participants will learn how to undertake basic air-sealing, insulation and conservation measures to reduce fuel and electricity consumption.

Attendees will also learn about the Home Performance with Energy Star (HPwES) program run by the state’s electric utility companies. HPwES is open to all NH families, based solely on whether your home has a higher than average heating energy consumption.

New England Home Comfort is offering a $100 Energy Audit for NH residents who qualify.

AllUEL resident workshops are free and open to the general public. For more information on dates and locations for upcoming workshops visit: http://www.myenergyplan.net/buttonup.

If interested in hosting a Button Up NH Workshop in your community, contact Zak Brohinsky, zak@plymouthenergy.org, 603-536-5030 or Michael O’Leary, molo3766@tds.net, 603-469-3233.

The Button Up NH program also includes a ten-week energy education curriculum focused on providing the building and operation knowledge you need to make sustainable building decisions. It is open to the general public. For more information on dates and locations for upcoming workshops visit: http://www.buttonup-up.org.

The Button Up NH Workshops are open to the general public. For more information, call Zak at 603-536-5030 or e-mail zak@plymouthenergy.org.

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STATE DEPT. TURNS A BLIND EYE TO UGLY REALITY OF TAR SANDS

“The State Department study turns a blind eye to the ugly reality that extracting and refining dirty tar sands oil—an enormous threat to our atmosphere and more and more of the greenhouse gases that cause global warming. To my mind, global warming is the most serious environmental crisis facing the world today and President Obama should block construction of the Keystone Pipeline.”

— Vermont Senator Bernie Sanders, 1/31/2014

NEW TV SHOW ABOUT ENERGY

A new TV show, “Energy Week with George Harvey and Tom Fennell,” is being shown on BCTV in the Brattleboro area, and it is available to be seen on any public access television station that wants to use it. It can also be seen on streaming video at the Green Energy Times website, www.greenenergytimes.com.

In each show, George and Tom talk about the news of the week. The plan is that guests will appear regularly, and the people who have said they would like to attend make up a promising list. You are all invited to watch. 

CONGRESS SHOULD PUT A PRICE ON CARBON POLLUTION

Cont. from page 17

federal government will take to address climate change. In other words, some of the very companies that have strongly opposed action to address climate change are recognizing that carbon pricing - a fee based on the amount of carbon pollution that some sources of energy release into our air - is likely.

The goals of carbon pricing include curbing our fossil fuel use, encouraging lower carbon emissions, creating jobs and spurring innovation. Cutting carbon pollution will help keep our air and water clean and protect our children from respiratory illnesses such as asthma. It also will help families and businesses across America save money.

There is a growing consensus that putting a price on carbon pollution is the most effective way to fight global warming. Pricing carbon has been endorsed by people across the political spectrum, including prominent conservatives George Shultz, Nobel laureate economist Gary Becker and President Obama's former economic adviser Gregory Mankiw.

The scientific community is virtually united in saying that global warming poses an enormous threat as it is caused largely by human activity. The insurance industry, which views the costs of climate change in starkly economic terms, also has weighed in. Munich Re, the largest reinsurance company in the world, calculated that the cost of damages from natural catastrophes in the United States exceeded $139 billion in 2012 alone.

“Climate change,” they report, “represents a threat to our business.” National security experts, including the top US military officer in charge of Pacific security, Navy Admiral Samuel J. Locklear III, have identified climate change as the largest long-term security threat to the Pacific region. As sea levels rise and food production is severely undermined by climate disruption, potentially millions of people could be displaced, conflicts over resources will be amplified, and entire regions of the globe will become destabilized.

To address this global crisis, we introduced the Climate Protection Act. Our bill would establish a fee on each ton of carbon pollution emitted from the fossil fuel we produce and import. It would return 60 percent of the revenue directly to taxpayers.

The act would use the remaining revenue to support sustainable energy research, weatherize homes, help businesses save money through energy efficiency; grow the economy, and reduce the deficit. Our bill would reverse carbon pollution and help create millions of jobs as we transform our energy system away from fossil fuel and toward energy efficiency and sustainable energies like wind, solar and geothermal.

“Such policy frameworks would protect our economic growth while protecting vulnerable consumers by putting money right back in their pockets,” said Public Citizen’s Tyson Slocum. “It rewards those who use less energy at home, and it invests in retrofitting and preparing the homes and communities most vulnerable to violent weather and high energy costs.”

In addition to calling for action on climate change, many of the nation’s largest corporations are incorporating carbon pricing into their strategic planning, including Microsoft, General Electric, Walt Disney, ConAgra Foods, Wells Fargo, DuPont, Duke Energy, Google, Delta Air Lines, ExxonMobil, ConocoPhillips, Chevron, BP and Shell. ExxonMobil expects that carbon pollution eventually will be priced at about $60 a ton, three times more than our bill proposes.

Climate change is the single greatest threat to our country and our planet, and future generations will look back to this moment and judge us by the decisions we make today. The scientific community, those responsible for protecting our national security, the American public and corporations increasingly are recognizing that climate change is happening now and that carbon pricing is likely to be part of the solution. It is time for Congress to act.

Sens. Barbara Boxer, D-Calif., a chairman of the Senate Environment and Public Works Committee and Sen. Bernie Sanders, an independent from Vermont, is a member of the environment and energy committees.
Energy-efficient windows provide space heating and lighting to this sunny kitchen. [Ask Loewen for pic]

The windows in your house let in light and air if they are operable, but they can also be weak spots in your home's thermal envelope.

When replacing windows, purchase the most energy-efficient windows you can afford, because they will pay for themselves over their lifetimes.

When building our homes with light, warmth, and ventilation, but they can also negatively impact a home's energy efficiency. You can reduce energy costs by installing energy-efficient windows in your home. If your budget is tight, energy efficiency improvements to existing windows can also help.

Improving the Energy Efficiency of Existing Windows

You can improve the energy efficiency of existing windows by adding storm windows, caulking and weatherstripping, and using window treatments or coverings.

Adding storm windows can reduce air leakage and improve comfort. Caulking and weatherstripping can reduce air leakage around windows. Use caulk for stationary cracks, gaps, or joints less than one-quarter-inch wide, and weatherstripping for building components that move, such as doors and operable windows. Window treatments or coverings can reduce heat loss in the winter and heat gain in the summer. Most window treatments, however, aren't effective at reducing air leakage or infiltration.

Selecting New Energy-Efficient Windows

If your home has very old and/or inefficient windows, it might be more cost-effective to replace them than to try to improve their energy efficiency. New, energy-efficient windows eventually pay for themselves through lower heating and cooling costs, and sometimes even lighting costs.

When properly selected and installed, energy-efficient windows can help minimize your heating, cooling, and lighting costs. Improving window performance in your home involves design, selection, and installation.

Design

Before selecting new windows for your home, determine what types of windows work best and where to improve your home's energy efficiency. ENERGY STAR® has established minimum energy performance rating criteria by climate. However, these criteria don't account for a home's design, such as window orientation.

Windows are an important element in passive solar home design, which uses solar energy at the site to provide heating, cooling, and lighting for a house. Passive solar design strategies vary by building location and regional climate, but the basic window guidelines remain the same—select, orient, and size glass to maximize solar heat gain in winter and minimize it in summer.

In heating-dominated climates, major glazing areas should generally face south to collect solar heat during the winter when the sun is low in the sky. In the summer, when the sun is high overhead, overhangs or other shading devices prevent excessive heat gain.

To be effective, south-facing windows should have a solar heat gain coefficient (SHGC) of greater than 0.6 to maximize solar heat gain during the winter, a U-factor of 0.3 or less to reduce conductive heat transfer, and a high visible transmittance (VT) for good visible light transfer.

Windows on east, west, and north-facing walls should be minimized while still allowing for adequate daylight. It is difficult to control heat and light through east and west-facing windows when the sun is low in the sky, and these windows should have a low SHGC and/or be shaded. North-facing windows collect little solar heat, so they are used only for lighting.

Low-emissivity (low-e) window glazing can help control solar heat gain and loss in heating climates.

If you're constructing a new home or doing some major remodeling, you should also take advantage of the opportunity to incorporate your window design and selection as an integral part of your whole-house design—an approach for building an energy-efficient home.

Selection

When selecting windows for energy efficiency, it's important to first consider their energy performance ratings in relation to your climate and your home's design.

This will help narrow your selection. A window's energy efficiency is dependent upon all of its components. Window frames conduct heat, contributing to a window's overall energy efficiency, particularly its U-factor. Glazing or glass technologies have become very sophisticated, and designers often specify different types of glazing or glass for different windows, based on orientation, climate, building design, etc.

Another important consideration is how the windows operate, because some operating types have lower air leakage rates than others, which will improve your home's energy efficiency. Traditional operating types include:

- Awning. Hinged at the top and open outward. Because the sash closes by pressing against the frame, they generally have lower air leakage rates than sliding windows.
- Casement. Hinged at the sides. Like awning windows, they generally have lower air leakage rates than sliding windows because the sash closes by pressing against the frame.
- Fixed. Fixed panes that don't open. When installed properly they're airtight, but are not suitable in places where window ventilation is desired.
- Hopper. Hinged at the bottom and open inward. Like both awning and casement, they generally have lower air leakage rates because the sash closes by pressing against the frame.
- Single- and double-hung. Both sashes slide vertically in a double-hung window. Only the bottom sash slides upward in a single-hung window. These sliding windows generally have higher air leakage rates than projecting or hinged windows.
- Single- and double-gliding. Both sashes slide horizontally in a double-sliding window. Only one sash slides in a single-sliding window. Like single- and double-hung windows, they generally have higher air leakage rates than projecting or hinged windows.

Installation

Even the most energy-efficient window must be properly installed to ensure energy efficiency. Therefore, it's best to have a professional install your windows.

Windows should be installed according to the manufacturer's recommendations and be properly air sealed during installation to perform correctly. Learn more in Energy-Efficient Windows Part 2 in our April 15th Issue of Green Energy Times.

Source: http://energy.gov

**Window Types**

Energy-efficient windows come in traditional styles such as awning, hopper, and sliding windows. Each type has its own advantages and disadvantages. Choose the one that best suits your needs and budget.

**Rock Wool**

By George Harvey

When rock wool was invented in the 1840's no one was especially interested. It was re-introduced in the 1870's, but mostly passed from use. Now it is being brought back to market, with a new set of 'green' credentials, and people who understand it are paying attention.

Rock wool, also called mineral wool or stone wool, is a man-made product. It is spun from various sources, including rocks and slag. It is similar to the fiberglass used in insulation, but has some advantages of its own.

It is used mostly for thermal insulation. While it is good at this, it also is effective to dampen sound. Its other attributes make it more attractive than other types of insulation for a number of applications. It is not attractive to vermin, and does not support growth of mold or mildew even if it gets wet. One really important characteristic is that it is a good barrier to fire. It can provide an insulation value of R4 per inch, which is similar to dense fiberglass and blown cellulose.

It can be used in a number of ways. It can be blown into hollows in walls and similar places. It is used to provide insulation in modular products, such as structural insulated panels. It can be applied in batts. These forms of insulation are now becoming more available, as large companies are making them. Owens Corning produces the Thermafiber brand. Roxul, a subsidiary of the Danish company, Rockwool International, may be the largest North American producer, selling its product under its own name. There are a number of smaller producers as well.

Rock wool may not be the first thing to come to mind, when insulation is considered, but it deserves some thought. Eric Solsaa, of Solsaa Energy Solutions in Rutland, Vermont, specializes in insulation. Several years back he faced a somewhat unusual problem of having to fill architectural spaces as large as 14 inches. “I was not comfortable about the idea of filling this space with blow-in cellulose,” he said, “so I started doing a web search for alternatives”.

Eventually, Eric found a company in Texas that could provide him with what he wanted. “The rock wool was mixed with a binder for this,” he said. “It came in a five-gallon tub, to be mixed with water. The rock wool was then blown into the spaces.”

Eric says not everyone he knows in the insulation industry likes blowling rock wool with a binder, because it is hard on some types of machines. Nevertheless, he uses it and is happy with the results.

He is particularly happy with two points. One is that damp rock wool seems to lose its moisture faster than cellulose would. This is very important in frame buildings. Another thing is that rock wool is a good fire barrier, and so contributes to the safety of a building where it is used.

Though a number of insulation specialists who blow in rock wool, not all do. Solsaa Energy Solutions in Rutland, Vermont can be found at http://www.rutlandinsulation.com. Another is Green Cocoon, in Salisbury, MA, whose web site is www.thegreencocoon.com.
By George Harvey

How would you feel if you heated, cooled, and lighted your home with electricity, but when the utility statement came, it included a check made out to you? How would you feel if the check covered the cost of all other energy used in the house, such as the propane you used to heat water and cook? How would you feel if there were enough left over to go out to dinner and celebrate?

If you can picture that in your mind, you can picture going beyond efficiency, past net-zero, all the way to net-positive energy production (also called “net-negative use”). If you have net-positive production, you are making more power than you use. Net positive production is not just a theoretical goal. It is a goal that is being met.

Wes Parlee owns a net-positive producing house in Devens, Massachusetts. He explains the feeling of being net-positive with these words: “I know it sounds funny, but it almost feels like stealing. It’s amazing!” His average cost for utilities is a monthly credit of $58.

It may feel like he is stealing, but it is hardly undeserved. When he started planning his new house, he turned to Carter Scott of Transformations, Inc., which is located in Townsend, Massachusetts. Transformations teamed up in 2009 with Building Science Corporation, a research partner with the Building America Program of the, U.S. Department of Energy (DOE), to learn and apply the latest in building science techniques.

The result of Carter’s experiences is a sure knowledge of an intricate set of scientific, architectural, engineering, and construction principals that allow him to sum up in a single structure all the values connoted by a single, simple English word: cozy.

A more technical description includes the facts that above ground, the building is double-walled and has insulation of R-45.6. The ceiling has insulation of R-67. The slab is insulated to R-10, and the foundation walls to R-20. Windows are R-5.0 and are carefully sealed and flashed; their solar heat-gain coefficient is 0.19. As a last touch, attention to air leakage was careful enough that blower door testing produced results significantly better than standard.

Heat is supplied by super-efficient air-source heat pumps that are at 92% of rated efficiency when the outside temperature is 5°F, and 58% when the temperature drops to -13°F. During the summer heat, the same equipment can cool the house, but with so much insulation cooling is generally not necessary.

There are no incandescent lights used, and so far all lights are CFLs. All appliances are ENERGY STAR rated.

The house would have a Home Energy Rating System (HERS) rating of 34, if it did not have a PV system. With solar power part of the plan from the start, generous roof space was allocated to a system of 78 PV panels with a combined rated output of 18.33 kW, and an expected annual output of 10,200 kWh. This brings the house to a HERS rating of –21, a rating that means that the house generates a good deal more power than it uses.

BUILDING EFFICIENCY

BUILDINGENERGY 14: A CULTURE OF Curiosity

By Travis A. Niles

The Northeast Sustainable Energy Association (NESEA) and its members are organizing the BuildingEnergy 14 Conference and Trade show at the Seaport World Trade Center in Boston, March 4-6, 2014. This event is the region’s oldest gathering of high performance building and renewable energy practitioners. Known as “BE” to regulars, it’s so much more than an educational and networking event. It’s a nexus of creativity and knowledge for those passionate about building a better world. In the words of NESEA Member and Conference Track Chair Fred Unger, BE stands out because of the “technical proficiency and culture of curiosity” that prevails throughout the conference, indeed, it is for this reason that he hasn’t missed a conference since the late 1980’s. South Mountain Company’s John Abrams concurs, saying “it’s become home. It’s gravity...it’s an important part of my life.”

Unwavering Commitment To Doing The Future Right

NESEA got its start in the late 1970’s in Brattleboro, Vermont as the New England Solar Energy Association, a grassroots organization comprised of solar energy pioneers that advocated for renewable energy adoption. Its conference has known different names, different themes and venues through the years, but at all times, it was known as the place to be to get the pulse of the New England energy market. This was, in part, due to the multidisciplinary nature of the people it attracted. Says Unger of his early days with NESEA and BE “nowhere else have I found such a multi-disciplinary group that demands honesty, competence and credibility from everyone.” The organization and its conference grew and evolved through what could be called a “cycle of empowerment.” As the renewable energy and green building fields grew, practitioners ran into challenges trying to do the best possible work. They asked tough questions and found answers - and kindled spirits - with NESEA connections, and through the conference they were able to educate and energize others who shared in their struggle and their commitment to building a sustainable future. This process of creating a conference by practitioners, for practitioners, means rigorous vetting of hundreds of ideas, and a fair share of “no’s.” But this distaste for greenwashing and preference for open, honest learning clearly works, as NESEA is gearing up to once again welcome 130 exhibitors and 3000 attendees to the Seaport World Trade Center.

The Pursuit of Mastery

This year’s BuildingEnergy theme is Advancing Your Practice, and there will be plenty of opportunities to do just that. The conference offers over 80 fully accredited educational sessions and workshops on green homes, energy policy, sustainable building materials and green business. It will also feature a Keynote Address by architect Amanda Sturgeon, Program Director of the Living Building Challenge. Ms Sturgeon will be speaking on how to advance sustainable, accountable design into the next century. Other featured events include the presentation of the $10,000 Zero Net Energy Building Award and Student Design Competition Award Ceremony.

There’ll also be plenty of networking opportunities for current practitioners and job-seekers alike. As Fred Unger recounts, “I’ve made a number of career moves over the years, and I can say with absolute certainty that when I’ve made these changes, it’s the things I’ve learned and the people I’ve met through NESEA and the BuildingEnergy conference that made those transitions successful.”

The energy and building markets are evolving rapidly. Now is the time to be paying attention to the issues, to build buildings and systems with purpose and integrity. Join NESEA in Boston for BuildingEnergy 2014. More at www.nesea.org/buildingenergy.

Top: Speakers and attendees swapping stories on the Show Floor of BuildingEnergy 13 before joining a special alumni session of the BuildingEnergy Competition Award Ceremony.

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TimE TO BREAK OUT OF NEW HAMPSHIRE’S ENERGY EFFICIENCY DOLDRUMS

By Laura Richardson

When the thermometer reads 10º below zero and four inches of poor insulation separates you from the bitter cold, you might consider what it takes to raise the interior temperature 70º to keep your home or business reasonably warm — and what impact that has on everyone else.

At a recent Business and Industry Association meeting, Democratic Rep. David Borden of New Castle noted that each year in New Hampshire we spend about $6 billion on energy, and we probably waste a third of that. I think his estimate is conservative; our buildings hemorrhage energy.

High demand combines with limited transmission capacity to make high costs, and these result in reduced productivity and layoffs. Yet some people complain that they could not stomach expanded public funding for energy efficiency, when they are already faced with exorbitant energy costs.

There is a direct connection between cost volatility for industrial energy users and demand spikes from other sectors. Improving the energy performance of residential, municipal and commercial buildings would mean less energy needs to be transmitted. In many cases a 50% reduction of energy use is quite feasible — which in turn would reduce energy demand system-wide, and thus reduce energy prices for everyone. There is no rate of return on wasted energy.

New Hampshire has studied this problem for many years, with one study leading to another, but very little action. An effort to develop an energy strategy for New Hampshire, currently under way, should provide additional guidance on next steps. Certainly, ramping up energy efficiency efforts in buildings will be a key recommendation. Can’t we start working on it sooner rather than later?

Adding pipelines and transmission lines is not a solution; they simply provide a mechanism to waste more. Energy efficiency should be considered an energy resource. If we can better manage energy use, we don’t need to expand energy capacity. In many cases, it is less expensive to “buy” energy efficiency than to buy the energy itself. “Least-cost procurement” is a Yankee attribute we have so far failed to incorporate into our utility regulations and energy practices.

Our reason include saving money,Cont. on page 34
By Indigo Ruth-Davis

Head north leaving Montpelier, Vermont, hang a right, and before you know it, you’ll be lost on the dirt roads that crisscross the foothills of the Green Mountains. On the side of one of these hills, a crew of workers is installing triple pane, high-solar-heat-gain, R-9 windows on a super-insulated timber frame house. These windows will provide more heat to this house than its entire heating system. Active heating will be necessary only on the coldest winter days. On those cold days the house will be heated with the equivalent of fifteen 100w light bulbs.

This is the Timber Frame Passive House Cottage. The setting is rural, the style, well, DIY-rustic, and its design is certified passive. While the tools to build a house that performs this well are basically the same as a conventional building, the design process requires a new set of tools.

The secret to a Certified Passive House Consultant is The Tool Box, which consists of:

- The Passive House Planning Package, an energy modeling program
- WUFI-ORNL, a Hygrothermal analysis program
- THERM, a thermal bridge analysis program
- The Solar pathfinder, a shading calculation tool

The most important of these tools is the Passive House Planning Package (PHPP). It was developed by the Passive House Institute, (in Germany) in the 1990s — to simplify the energy balance calculations that are necessary to meet the Passive House standard. Areas for each building component, R-values, window performance values, shading conditions, and information about the mechanical systems are entered into the program. The PHPP combines this with climate data and calculates the energy use of the building’s design.

At the cottage, clients Greg and Barb Whitchurch knew they wanted to build a small, well insulated house for their parents. When Greg showed me Barb’s sketch of what they had in mind, I said “that’s a Passive House.” This project didn’t have a professional architect, so getting there required intense collaboration among the homeowner, the builder Chris Miksic of Montpelier Construction and me, the certified Passive House consultant.

The first step is to complete a rough PHPP. Every building’s geometry, size, orientation and climate have different implications for its energy balance. This is the heart of performance-based design. In our case the Passive House design criteria of 4.75 kBTU/sq. ft./yr. called for 16 inches of dense-pack cellulose for R-56 walls and 22 inches of dense-pack cellulose for an R-77 roof. This is based on the maximum allowable air tightness in a Passive House of .6 ACH@50 pascals. The initial PHPP takes a few days to complete.

The next step is to analyze the site’s shading conditions. Harvesting heat from the sun is serious business in a Passive House, so accuracy in the shading analysis is all-important. For complex shading conditions such as mountainous locations this is best done with the Solar Pathfinder. The Solar Pathfinder consists of a dome that projects shading objects at the building site onto a sun-path chart. Shading percentages are tallied and then entered into the PHPP for radiation reduction factors.

Before the assemblies are finalized they should be analyzed for moisture and mold risk. Hygrothermal analysis is more important in high-performance building than in conventional building because of higher temperature differentials within the wall assemblies. I use WUFI-ORNL for this analysis because it’s free and is suitable for most non-commercial construction.

In our project the roof design required special attention. The plan called for 22 inches of cellulose under a flat unvented membrane roof. On a flat roof, condensation risk is usually mitigated by adding vapor closed foam insulation to the outside of the assembly to a thickness.

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SUSTAINABLE AGRICULTURE

EFFORTLESSLY GROWING PLUMS IN VERMONT

By David Fried

Everyone is planting gardens. But who is planting fruit trees and nut trees? While you have to plant a garden every spring, you only plant a fruit tree or a nut tree once, and it bears fruit for a long, long time. Let your tree’s roots mine the moisture and nutrients it needs, while you have more time to play with your kids, to write a book or hike a hill.

Real permaculture is seeing what you can do in your yard and on your hill to feed yourself and your family and using that wisdom throughout your life. Living with fruit and nut trees, they will teach you as you go. Don’t be hesitant. Start planting. Be fruitful. And we will coach you along the way...

If you are walking next to me in late August and September, your shirt will be ruined. These hills are a place where plum trees grow and when they are ripe. The plums are so juicy that one bite sends their mango-like nectar spurting over whatever you are wearing, so watch out.

Would you like to taste a golden plum? A red one? A purple one? We have them all. Would you like to taste a golden plum? A red one? A purple one? We have them all. Would you like to taste a golden plum? A red one? A purple one? We have them all.

Websites on ventilation can be found at www.greenenergytimes.net/ventilation-links.

LOW ENERGY VENTILATION

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outside air and polluted inside air. Energy recovery ventilation systems provide controlled ventilation while minimizing energy loss. A large part of the costs of heating ventilated air in the winter by transferring heat from the warm inside air being exhausted to the fresh (but cold) supply air. In the summer, the inside air cools the warmer supply air to reduce ventilation cooling costs.

Heat pumps can be an energy-efficient option that combine heating, cooling and a healthy air exchange natural system.

Ventilation for Cooling

Ventilation for cooling is the least expensive and most energy-efficient way to cool buildings. Ventilation works best when combined with techniques to avoid heat build-up in your home. In some climates, natural ventilation is sufficient to keep the house comfortable, although it usually needs to be supplemented with spot ventilation, ceiling fans, window fans, and—in larger homes—whole-house fans.

Ventilation is not an effective cooling strategy in hot, humid climates where temperature swings between day and night are small. In these climates, however, natural ventilation of your attic (often required by building codes) will help to reduce your use of air conditioning, and attic fans may also help keep cooling costs down.

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MORETOWN’S SECOND PASSIVE HOUSE

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determined in the building code for each climate zone, or by back venting below the roof deck. When I modeled the proposed unventured roof, WUFI-ORNL indeed predicted that the assembly would not be able to dry out and therefore the moisture content in the building materials would slowly rise over the seven year period that I analyzed. I compared this assembly to a back vented assembly. The results were dramatic. With only 1 ACH in the back venting plane, the roof assembly showed a significant dry-out over the seven year period. Based on these results I advised my client to add a ventilation plane to the roof assembly.

The final step in the design is to look for potential thermal bridges and either eliminate them, or account for them in the PHPP. Thermal bridges that can’t be eliminated need to be modeled in a two-dimensional heat transfer program such as THERM, which is free from the Lawrence Berkeley National Lab.

Our biggest thermal bridge concern was our window connection mullions. To determine if they were a thermal bridge I first drew them in THERM with the window frame geometry. Then THERM runs a heat transfer simulation with and then without the mullion. The conductance of just the mullion is determined by subtracting the results with the mullion from those without the mullion. This number is entered into the PHPP. The thermal mullion bridge ended up throwing off our energy balance and was a condensation risk. We used THERM again to determine that an exterior trim piece that incorporates an EPS foam plug significantly improves this thermal bridge.

I enjoy being able to bring the precision of the PHPP, WUFI and THERM to the design process. Informed decisions instead of best guesses becomes the basis for a Net Zero-ready design fit for the 21st Century.

Indigo Ruth-Davis is a Passive House Consultant and builder. He is a partner at Montpelier Construction, one of central Vermont’s leading building performance companies.
Algae are an excellent source of oil for produce can be extracted and processed and energy. The lipids, or oil, that algae generate and phosphorous to make biomass dioxide and taking up nutrients like nitrogen and oxygen on the planet, while consuming feed.

Oil for fuel and algae for animal or fish management while also producing biofuels and other products here in Vermont, including videos, reports, an image gallery, and helpful links, visit www.vermontbioenergy.com/algae.

The Vermont Bioenergy Initiative is a program of the Vermont Sustainable Jobs Fund and partners with other organizations expanding the use of renewable energy in Vermont like Renewable Energy Vermont and the Energy Action Network. The Vermont Bioenergy Initiative also coordinates crossover with the Vermont Farm to Plate Network by providing resources and technical assistance to farmers, facilities, and communities to support energy crops to be grown alongside food production. www.vermontbioenergy.com

By Sarah Galbraith, program manager of the Vermont Bioenergy Initiative

A great deal of interest about the potential of oil-rich algae as a bioenergy feedstock has surfaced in recent years. It’s already big business in certain parts of the world. In the United States, students, researchers, and innovators are looking for ways for algae production and processing to accomplish wastewater and nutrient management while also producing algal oil for fuel and algae for animal or fish feed.

Algae produces more than half of the oxygen on the planet, while consuming vast amounts of heat-trapping carbon dioxide and taking up nutrients like nitrogen and phosphorous to make biomass and energy. The lipids, or oil, that algae produce can be extracted and processed into renewable fuels such as biodiesel. Algae are an excellent source of oil for making biodiesel, which could displace substantial volumes of petro-diesel for heating and transportation. Microalgae reproduce rapidly, and they grow on non-agricultural land, so they do not compete with food, feed, or fiber production.

With funding from the US Department of Energy secured by US Senator Patrick Leahy, the Vermont Bioenergy Initiative has supported a number of algae to biofuel research projects. This early-stage research and development is determining the most viable and cost-effective methods for accessing algae’s commercial potential to produce clean renewable energy while treating wastewater and supplying nutrient-rich feeds and food.

Dr. Anju Dahiya, president of General Systems Research (GSR) Solutions, a recipient of grant funds from the Vermont Bioenergy Initiative, has been looking for high lipid algae strains, and scaling those up to a level that could be available for commercial use, especially for biofuels. “At GSR Solutions, we are looking at producing algae not just for biofuels, but combining it with wastewater treatment and to produce other valued byproducts as well. This is very significant, because this would make algae production cost-effective. This would also help in nutrient recovery,” says Dahiya.

GSR Solutions will be assessing the feasibility of growing oleaginous algae strains in the company’s private lab in Burlington for up-scaling with waste streams from dairy farms and breweries. These strains will create a biodiesel product that is interchangeable with home heating oil, diesel, and jet fuel. In addition, the process can produce an organic fertilizer that can substitute for imported synthetic versions.

For more information on the potential for algae to substitute for imported synthetic versions, visit www.vermontbioenergy.com/algae.
HILLTOP MONTESSORI SCHOOL IS 100% SOLAR POWERED, INSTALLED AT NO COST!

By N.R. Mallory

Hilltop Montessori School in Brattleboro, Vermont, is an independent school for children age 18 months to 8th grade. "The installation of solar will allow the school to further its mission," the head of the school, Tamara Mount, stated, "teaching students about conservation and renewable energy -- taking care of our planet, which is an important part of Montessori educational philosophy." On Dec. 31, 2013, Hilltop Montessori School activated 192 roof-mounted PVs, which will generate approximately 60,000 kilowatt-hours of electricity per year. The 11.4kW system has 192 Hanwha 250W PV Modules and four Fronius Isolated String Inverters. It will supply the school with 100% of the power it needs.

The solar system is monitored with a Fronius Web-based monitoring system. The school is awaiting a grant from Solar4RSchools for a computer kiosk for the lobby, as well as other educational materials. "Integrated Solar shepherded the project through to fruition. They conducted feasibility studies, introduced the school to investors, and installed the system. It was a turn-key product," said Seth Harter, one of the parent volunteers who helped the school explore the possibility of solar power. "It’s been wonderful working with them and a fantastic opportunity for the school."

The solar array was installed at no cost to Hilltop. Wisdom and Power LLC invested the capital to install the array and in return, Hilltop will pay the firm 90% of the current kWh rate for service from Green Mountain Power. After seven years, the school may choose to purchase the panels at fair market value, or continue to pay the investor. Hilltop moved to its current location five years ago, after renting space at the Austine School for the Deaf. On the newly purchased property, they built a new building designed to be as energy efficient as possible, and with the forethought of installing solar panels. They are currently building an 'arts barn,' and a multi-purpose building, both built with energy efficiency in mind. Both buildings have SIPs panels manufactured locally at Foard Panels in West Chesterfield, NH.

"Our school culture incorporates other sustainable measures, like composting, recycling and gardening," said Development Director Amelia Farnum. "The students take responsibility for all of these - students as young as three learn which bin is for recycling, which is for composting and which is for trash. Older children have ‘jobs’ of collecting compost and recycling." The school is situated on 43 acres, including a large garden. They have also done some routine weatherization. This includes an energy assessment of the school done by the Vermont Superintendents Association and an energy audit done by Farnum Insulators.

Filling their mission step by step is becoming a reality for Hilltop Montessori School. The children who are fortunate enough to attend the school are learning to walk a sustainable path that will lead to a responsible future.

SUSTAINABLE EDUCATION

EXPLAINING GLOBAL WARMING TO OUR KIDS

By EarthTalk*

Kids today may be more eco-savvy than we were at their age, but complex topics like global warming may still mystify them. Luckily there are many resources available to help parents teach their kids how to understand the issues and become better

Many thanks to our sponsor:}

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Middle Schoolers with their composting/recycling "center" that they built.

South facing roof of Hilltop Montessori School. The 11.4kW system consists of 192 Hanwha 250W PV Modules.

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By George Harvey

Can you imagine anything more exciting than an anaerobic digester, filled with waste food scraps from a school cafeteria, agricultural spoilage, chopped hay, and lots and lots of manure, pumping out methane (aka swamp gas)? If you can answer “yes” to this question, I suggest a chat with Mary O’Leary, an Assistant Professor at Vermont Technical College in Randolph. She may not change your answer, but she will, at the very least, make you understand the question in a new light.

Mary is the project manager of VTC’s new Anaerobic Digester Project. The project is under way, and is expected to produce heat and power from the beginning of March. It is expected to produce 375 kW of power, and the waste heat from the generator will be captured to heat four buildings, which will be connected in time. Anaerobic digestion is a natural process, which can be understood from the workings of a cow’s stomach. Bacteria break down cellulose and other nutrients, using some of the energy in them as food. If there is no oxygen available, the bacteria ferment the food in a way that releases methane gas.

Methane from the process is the most important constituent of natural gas, and can be used just about anywhere natural gas is used. In the case of VTC, the gas is used to run a generator, supplying power to the grid as a net-metered project. When waste heat is captured, the whole process is highly efficient.

Best of all, the VTC anaerobic digester provides a set of very important benefits to the environment. One is that it is a renewable source of both electricity and heat.

Another environmental benefit is that the system prevents methane from manure from getting into the atmosphere. Methane is estimated as having twenty to forty times the power of carbon dioxide as a greenhouse gas, burning it to carbon dioxide is a benefit, for global warming. Additionally, by intercepting waste from various sources, the system reduces the load on conventional waste-handling facilities. The feedstock is 51% manure, spoilage, and hay. The rest will be food waste and by-products, including whey and waste from dining facilities. Various organizations are partnering with VTC for this, including local farms. Grow Compost will be supplying waste from food sources, and Highfields Center for Composting is working with VTC on training and research (links at the end of the article). Other waste may come from dairies, breweries, restaurants, and other sources.

The digester needs 450,000 gallons of feedstock just to get started. Once it is going, 15,000 gallons has to be added each day. Clearly, some of this would have been used as fertilizer in the past. There is no reason to feel bad about that, however, because the by-product of the process can also be used as fertilizer, and since non-agricultural waste is used, there is more of it. We might note that human waste will not be used, and permits to process food scraps have requirements for specific monitoring to make sure operations are within parameters for good health. That the system is handling food waste is especially important because we are currently phasing out sending such waste to landfills. It will no longer be legal to send food waste to landfills as of 2017.

Funding for VTC’s anaerobic digester included a $1.5 million grant from the Vermont Sustainable Jobs Fund capital funding comes from grants from the U.S. Department of Energy, obtained with the help of U.S. Senator Patrick Leahy, and bond funding from the Vermont State Colleges. And invaluable help and funding have been provided by many other generous organizations and individuals including Vermont’s Clean Energy Development Fund, the Vermont Agency of Agriculture, Food and Markets, the Vermont’s Agency of Natural Resources, Vermont’s Department of Public Service, the SPEED program, the Natural Resource Conservation Service, the Kresge Foundation, the Town of Randolph, and the Tri-Town Alliance.

Stone environmental (stone-env.com) did a map showing amounts of waste. Bio-Metatech of Quebec (bio-methatech.com) designed the Lipp AD system and is overseeing construction. J. Hutchins of Richmond, Vermont did the site work. R.G. Gosselin of Derby Line, Vermont (rggos-selininc.com) did the concrete work. Highfields Center for Composting (highfieldscomposting.org), Grow Compost (growcompost.com) accepts home food scraps, and these can be used. VTC’s digester has its own site at digester.vtc.edu.

SUSTAINABLE EDUCATION

VERMONT TECHNICAL COLLEGE’S ANAEROBIC DIGESTER

WWW.GREENENERGYTIMES.ORG  802.439.6675  FEBRUARY 15, 2014

VTC’s Anaerobic Digester. Photo courtesy of VTC.

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In Bloom in Keene, AUNE’s third annual nature preschool/forest kindergarten conference, May 16, in Keene, New Hampshire. Stay tuned for more information. Photo: Bob Barke
THE UN REPORT ON CLIMATE CHANGE

By George Harvey

The UN panel on climate change has issued its Fifth Assessment Report, Climate Change 2013. It makes one point very clear:

Climate change is real, and it is caused by human beings. The scientific community has come to the point that it sees no viable alternative to this view. There is no other scientific explanation for what is going on. Deniers of all stripes will doubtless continue to deny. Whether it is out of fear of some bogeyman, such as an attempt at world domination, or fear of losing a lifestyle that includes fast cars and an absolute right to run the furnace at 72°F while running the air conditioning at 68°F, they will deny. And how could we expect otherwise - after all there are still some who insist that the world is flat.

The report also makes another thing very clear:

Reducing the effects of climate change will require substantial and sustained reductions of greenhouse gas emissions. In a nutshell, that means being as efficient as possible, switching to renewable energy sources, and turning to a lifestyle calculable to be sustainable.

We might make the observation here that if a lifestyle is sustainable, then it includes an ability to survive. It should be obvious, but deniers tend to believe a non-sustainable lifestyle is okay, even though it clearly must end at some point. And why would anyone actually choose a social paradigm that is terminal?

Perhaps it needs to be pointed out that if we adopt a sustainable lifestyle, then we gain a possibility of achieving, at some point, a goal that is otherwise impossible: By living sustainably, we can live healthy, happy lives.

For those who object to this conclusion, it might be pointed out that this is not a guarantee; it is merely a statement of a possibility. However, the converse is also true:

By refusing to live sustainably, we cannot continue to live healthy, happy lives, because eventually we lose the ability to live at all.

TIME TO BREAK OUT OF NEW HAMPSHIRE'S ENERGY EFFICIENCY DOLDRUMS

Cont. from page 27

reducing susceptibility to price volatility, Yankee frugality, national security, reductions in greenhouse gas emissions, environmental benefits, improved comfort, efficiency-related jobs, economic development, and improved values of physical assets. Whichever your favorite reason may be - we need to stop wasting energy. Now. How should we do it? We should get past sticker shock and understand that what we do not spend on energy efficiency we will spend on energy. We are spending the same dollars. Only the energy efficiency dollars have a corresponding rate of return.

Laura Richardson is executive director of The Jordan Institute, a Concord-based nonprofit that helps commercial building owners significantly reduce their energy use.

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RESOURCES:

Efficiency VT: This is a must go to site for immeasurable amounts of info. www.efficiencyVT.com
Driessen.com: www.driessen.com Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency.
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
New York Solar Energy Industries Association (NYSSA) www.nysea.org
Clean Power Estimator: www.consumerenergycenter.org/renewables/estimator
Find Solar: www.findsolar.com
Energy Star Federal Tax Credits: www.energystar.gov/tax-credits
tax Incentives Assistance Project (TIAP): www.energystarincentives.org
www.sunsdesign.com/tools.php: Online info for solar benefit with house design. i.e. window overhangs, sun angle & path.
NERC: Independent rating & ranking system for the windows, doors, skylights www.nerc.com/
Solar Living Source Book: www.renewableenergyworld.com
Home Power Magazine: www.homepower.com
Solar Components: www.solar-components.com
Solar Systems: nesolar.com
National Solar Institute: www.nationalsolarinstituteUCE.
NeighborWorks Alliance of Vermont: Low-cost energy loans - www.rhhomeownership.org
Energy Guide: Unbiased advice about today’s energy choices. Find ways to save, lower your bills & help the earth’s environment - www.energyguide.com
Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home. A lot of great information - yes.lbl.gov
American Council for an Energy-Efficient Economy: Consumer guide to home energy savings - aceee.org/consumer
VT Energy Investment Corporation (VEIC): nonprofit organization that issues home energy ratings for new & existing homes. 802-639-0687 - www.veic.org
SmartPower: www.smartpower.org
Greywater Info: www.sunsdesign.com/greywater
Buildings Energy Data Book: buildingsdatabook.eren.doe.gov
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
VPQIR: understanding the clean energy resources available to VT - www.vpqir.org/Cleanenergyguide
Track the Stimulus Money: www.vcar.gov/Topics/home.aspx
Renewable Energy World: www.renewableenergyworld.com
Renewable Energy VT: www.REVermont.org
The Energy Grid: www.pvwatts.org
350-Vermont: General group that coordinates a variety of statewide actions. To join this group go to: groups.google.com/group/350-Vermont
Vermont Tar Sands Action Group: 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
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-liberation

“'A sustainable human population is one where the people living in a given geographically defined area do not live beyond the limits of the renewable resources of that area for either input (energy and matter) or output (food, material goods, and absorption of pollution)... thereby living in a manner that present and future generations of people, and all other life native to that area, will be able to enjoy a healthy habitat over the long term.’”

What is an optimum sustainable population for Vermont?
Read this valuable new report at www.vspop.org
When organisms are what happens when organisms are...
DANVILLE, WEST RUTLAND STUDENTS ELECTRIFY TALKING COW’S NAME

An animatronic cow that explains how cow poop can help generate electricity has an electrifying new name — Electra — thanks to two students on opposite sides of the state.

Jared McGee, a student at West Rutland Elementary School, and Dillon Brigham, a student at Danville School, both submitted the winning name, Electra, in a Green Mountain Power contest to name the talking cow in Rutland’s new Energy Innovation Center. More than 170 children across Vermont suggested names.

“The Greek name Electra means sparkling, shining, bright or radiant,” said GMP President and CEO Mary Powell. “We loved the name, because GMP Cow Power is ultimately derived from the sun. The sun helps farmers grow food for their cows, which in turn produce the fuel for cow power generation.”

Jared, 9, said he chose the name Electra because of how it sounds. “I wanted to give her a girl’s name that sounded like something to do with electricity,” he said.

Dillon, 9, said he came up with the name Electra in a similar way. “I chose Electra for the cow’s name because it reminded me of electricity,” Dillon said.

For suggesting the winning name, chosen by a panel of GMP employees, Jared and Dillon won ice cream parties for their entire classes. Jared, who is in Kathy Turgeon’s West Rutland third-grade class, toured the EIC on January 23rd with his classmates, who then feasted on Wilcox Dairy ice cream in GMP’s Innovation Workshop, a glass classroom meeting room and collaborative space within the EIC.

Dillon, a student in Barbara Havlley’s Danville fourth-grade class, also toured the facility and took part in the party, while his classmates in Danville enjoyed one at school at the same time.

Electra, a seven-foot-long, talking cow built by the Imagination Company in Bethel, is the centerpiece of a Cow Power exhibit at the EIC. Photo Credit: Green Mountain Power

On a recent visit to my son’s home, my daughter in law asked me not to put my OG tea bags in the bucket for the worm composting. Their own patented method of finding little pieces of plastic in their compost led to an eye opening discovery. The plastic was coming from the tea bags!

My research found this to be true, along with some better news. Read the following article written by Jamie Kiffel-Alcheh for Clean Plates, — N.R Mallery, Publisher by Jared Koch

So many of us enjoy relaxing with a hot cup of tea. Tea leaves have been shown to reduce the risks of cancer, heart disease, Alzheimer’s and Parkinson’s, and also to help lower cholesterol, and improve mental focus. But it turns out that some tea bags aren’t so heart-warming.

Certain ones are treated with epichlorohydrin, a plastic that helps to keep the bags from breaking. The problem is that epichlorohydrin can potentially break down in water… and be released into your drink. The EPA says drinking water with high levels of epichlorohydrin, over a long period of time, could cause stomach problems and an increased risk of cancer. For perspective: The EPA allows up to 20 parts per million in drinking water, and epichlorohydrin-containing tea bags may include 50 parts per billion. Although the EPA’s stated current goal is zero parts, you can continue to enjoy these toxin-free teas:

These bagged teas are all free of epichlorohydrin, as well as pesticides and artificial flavorings:

Numi Tea confirms, “Our teas are pesticide-free and non-GMO verified, and are corn and potato starch-based. The tags are made from 100% recycled material and soy-based inks.”

Rishi Tea’s certified organic teas are bagged with PLA—polylactic acid, creating “silken” bags. Unlike other “silky” bags, which can be made with PET plastic, these are corn and potato starch-based, Tea Buyer Jeff Chapman confirms, “Our Natural Fiber Loose Leaf Tea Filters are made without glue or any other binding agent.”

EDEN Organic’s company rep Wendy Esko confirms, “The bags are made from oxygen washed manila fibers with no polluting whiteners used. Once filled, the bags are crimped and sealed with 100% cotton string. No staples, plastics, or glue are ever used.”

Organic Stash’s website explains that “the filter paper used for Stash Tea bags is made from 100% cellulose fibers (wood) and is made to appear white by forcing air between the fibers. No bleach is used. The filtering paper is coated with a coating of 5% pound called epichlorohydrin, and does not contain any free epichlorohydrin.”

Choice Organic Teas company rep states “We pride ourselves on being pesticide-free as well as on having corn-based tea sachets.”

Two leaves organic tea company rep states “We currently use a non-heat-seal filter paper made from a select blend of high-quality manila hemp (abaca) fibers and wood pulp. The filtration paper does not contain epichlorohydrin, nor plastic or polypropylene. It is oxygen bleached using a natural process that is completely free of chemicals or toxins, including dioxin.”

Tetley Black & Green tea. Tetley’s new Black & Green (a blend of both varieties) uses Perfo paper bags, which are free of epichlorohydrin. The tea is also free of pesticides. And still, then straining your own organic loose teas, well — that’s safe-tea.

About Clean Plates: Jared Koch is CEO, creator and co-author of Clean Plates, the only nutritionist and food critic approved guide to the healthiest and most sustainable restaurants in New York. Jared believes in and shares how to live a conscious, healthier lifestyle through education, inspiration, resources, and support at www.cleanplates.com.
TOXIN-FREE CLEANING SOLUTIONS FOR A HEALTHY HOME

By Clare Innes

Why do we all spend time cleaning? Many reasons come to mind, including safety. It's just not safe to allow dirt and other messes to accumulate. But if you use toxic cleaners, doesn't that negate the whole reason you're spending all that time scrubbing away? When you use household products that have words like Warning! Danger! Poison! Caution! you might want to keep that toxic Pandora in her container and turn instead to alternatives.

These days, those alternatives are readily available. You can even check them out by viewing the consumer guides at the Environmental Working Group website (http://www.ewg.org/consumer-guides). Even better, you can make 'em yourself! That way you'll know exactly what's in that bottle. Here are some suggestions.

1. Add 1 to 2 cups of vinegar to the rinse cycle to deodorize and soften fabrics.
2. Use equal parts vinegar and cool water to remove tough stains and clean mold and mildew from tub and tile areas.
3. Make your own bathroom tub and tile cleaner: 1-2/3 cup baking soda; 1/2 cup liquid soap; 2 tablespoons vinegar; 1/2 cup water. Mix soda and soap. Then add water. Then add vinegar. Rinse thoroughly after use to avoid leaving a residue.
4. Make an antiseptic soap spray that won't kill the good microbes: 3 tablespoons liquid soap, 20 to 30 drops tea tree oil, 2 cups water. Mix in a spray bottle and apply.
5. Need a little air freshener? Dissolve 10 to 20 drops of essential oil in a tablespoon of rubbing alcohol. Add a cup of water and mix thoroughly. Pour into an atomizer bottle or spritzer bottle.
7. Deodorize your carpet by mixing a one-pound box of baking soda with a teaspoon of your favorite-smelling essential oil. Use a fork to work out the lumps. Sprinkle on the carpet. After an hour, vacuum as usual.
8. Drains can become smelly after a while. Freeshen them by pouring 1/2 cup of baking soda down the drain, followed by 1/2 cup of vinegar. Let it bubble for 15 minutes, and then pour down a full teakettle of boiling water.
9. When your garbage pail just won't let go of smells, mix a teaspoon of tea tree oil with 1 cup of baking soda. Mix with a fork to get rid of the lumps. Sprinkle in the bottom of the pail after the liner is removed. Periodically rinse the pail with vinegar and water and dry in the sun.

Clare Innes is the Marketing Coordinator, Chittenden Solid Waste District. E-mail: info@cswd.net, Hotline: 872-8111.
Winter time allows us the opportunity to bundle up inside, relax, and cozy up to a nice blazing fire. A time when the windows are closed, the doors are shut and drafts are kept to a minimum. And a time when indoor air quality plummets. This time of year many people have difficulty with indoor allergens. Sometimes chemicals build up and act as allergens – from carpets, perfumes, solvents, upholstery or paints. Other allergens come from pet hair, molds, cockroaches or dust mites. Some people will say they are allergic to dust, but it is really the dust mites and the enzyme they excrete that is the culprit in the allergic response.

Dust mites are tiny little things that love warm, moist air and feed off humans’ and animals’ dead skin. It is probably impossible to really get rid of them but certain precautions can keep them under control enough to minimize symptoms. Even pets can be allergic to dust mites!

Getting rid of them as much as possible and minimizing their food source is the best way to tackle the problem. Dust mites die at 135°F so a hot wash or dry should kill a lot of them. Low moisture also makes their life miserable enough so that they may perish – below 50% humidity. Freezing is another option which is easy to do this time of year. Take the old stuffed animals and pillows and put them on the porch for over 24 hours and that should do them in. Here are some general tips for keeping your air cleaner and reducing allergic reactions:

Vacuum frequently – use at least a HEPA filter; a central vacuum is ideal. Keep humidity at 30-50% to prevent mold and mites.

Wash bedding regularly in hot water; soaking for at least an hour. Or, dry in hot heat. (For you environmentalists, you can hang dry first, then dry for only 10 minutes to kill the mites.) Avoid fragrances or perfumes from personal care products, laundry soap, or candles. Put dust collectors and pillows outside for over 24 hours in below freezing temperatures. Use a wet mop instead of a broom, a damp cloth instead of a feather duster.

Cover mattresses and pillows with dust mite covers. Now breathe deeply!

Deborah DeMoulpied is owner and founder of Bona Fide Green Goods, an earth-friendly department store in Concord, NH. Bonafidegreengoods.com won the Webby Awards Green Honoree in 2011. Deborah is also faculty of the Anticancer Lifestyle Program, teaching patients about environmental toxins and healthful solutions.

Green Tips by Deborah DeMoulpied, Bona Fide Green Goods

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SNOWBOARD SUSTAINABILITY: MADE IN VERMONT

by Roger Lohr

Burton Snowboards in Burlington, VT is working to make snowboarding sustainable well into the future. Burton is the dominant snowboard product company, and this commitment to sustainability can be an example for other businesses in the snow-sports world to emulate.

Two fronts for sustainable efforts include an environmental focus on the full impact of Burton’s operations such as product design, development, manufacturing, packaging, and shipping, and a social focus on the people who support Burton, including factory workers, employees, dealers, riders, and communities.

The environmental focus is generally known in the world of business where each decision takes root with an eco-influence. Since 2008, Burton has focused on improving not just the use of sustainable materials, but the process as a whole. From the production of snowboards and outerwear to luggage and apparel, Burton incorporates a sustainable perspective everywhere possible.

For example, recycled plastic bottles are transformed into pellets; spun into thread to create fabric. The bluesign Restricted Substance List has been applied across all Burton factories and product teams are working to get as many bluesign-approved fabrics as possible into Burton lines in future seasons.

In 2012, Burton unveiled an enhanced manufacturing code of conduct and an extensive restricted substances list associated with the company’s finished goods factories and key materials suppliers. Audits of Burton suppliers are now being conducted to evaluate and address Burton’s social and environmental compliance with applicable global regulations and industry “best practices.” A social compliance policy is in place that ensures contracted factories uphold Burton’s standards and meet targets for continuous improvement, and supplier contract clauses deal directly with working conditions.

All Kenney, Burton’s global sustainability director commented “We’re seeing great progress throughout our supply chains. We’ve been able to reduce packaging dramatically, we have factories all over the world collaborating with us on an environmental facilities assessment, and we even have factories coming to us with new ideas around sustainability.” Burton has also included an employee-run environmental committee dubbed EPIC (Environmental Protection, Integrity, Conservation) that focuses on fun ways to improve the company’s impact on the environment.

Burton has placed in the top two spots on the Vermont alternative-commuting challenge and has received the silver ranking for a Bicycle Friendly Business by a national bicycle organization. The facility has showers, a secure bike shelter called “The Wheelhouse” and 15 loaner bikes for anyone to use around town. Community-building experiences, like free bagels for alternative commuters, group rides to work, and an annual competition for the most creative commute encourage, green commuting. A partnership with the local transportation agency offers free bus passes to all employees. Carpoolers get preferred parking with the slogan “Two or more, closer to the door. Carpool, fool!”

There are 18 composting and recycling stations throughout Burton’s headquarters and a group sorts through all of it to determine the progress toward zero waste and educate employees. Organic vegetable plots are available on site for employees, who want space to grow their own. More than 6% of all employees tend plots. In the mornings, Burton employees are offered complimentary organic fruit from a local food co-op and organic coffee and espresso from a Vermont coffee roaster. They’ve also partnered with a local company that supplies locally made organic hand soaps to employees.

Other social mores include bringing dogs to work, casual dress and flex Fridays in the summer (they get to leave at noon), and a free pass to a local mountain for unlimited snowboarding. Burton also offers fitness membership reimbursements to make staying healthy affordable.

Burton’s Women’s Leadership Initiative programs help to attract, retain, and promote women, increasing the number of women in leadership and influential positions throughout the organization. There are educational and social events for women throughout the year, like learn-to-surf outings, women’s ride days, learn-to-skate nights, and career development workshops.

For more info on Burton Snowboard’s commitment to sustainability, see www.Burton.com/sustainability.
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