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Solar & Wind Blow Away Natural Gas

By George Harvey



Photo credit: D. O'Keefe, Michigan Sea Grant. Creative Commons BY-SA 2.0.

The declining costs of solar photovoltaics (PVs) and wind turbines have had effects on the entire energy market. These are clear in data from the Federal Energy Regulatory Commission. The FERC says that in the first quarter of 2016, 98.6% of all new utility-scale generating infrastructure installed in the United States was renewable. Wind power was the most important, taking 54% of the total, while solar power was second, at 39.9%. New natural gas infrastructure came to an astonishingly small 1.4%.

We should bear in mind that these figures are only for utility-scale infrastructure. Small scale PV installations typically make up 40% or more of solar capacity additions. If that is the case for the first quarter, then over half of new generating capacity for the period was solar.

Fossil fuel installations are increasingly giving way to renewable power. In the past few years, coal-burning electric generation has been in serious decline. In 2013, coal saw 1543 megawatts (MW) of new capacity added. This dropped to 166 MW in 2014, and only 3 MW in 2015. So far there has been none this year.

Cheerleaders for the natural gas industry have claimed credit for the decline in coal's fortunes. They pointed to the fact that new natural gas infrastructure additions grew from 7378 MW in 2013 to 9424 MW in 2014. The growth has turned out to be unsustainable, however. There was a large decline to 5952 MW in 2015. And only 19 MW of new natural gas capacity went online in the first quarter of 2016.

To be honest, we can be sure that the first quarter will not be typical for 2016. The outlook for natural gas is that about 4,000 MW of natural gas will be installed over the summer, along with a 1,150-MW nuclear reactor, the first in the United States in over twenty years.

Nevertheless, despite any summer additions to natural gas capacity, the sun and wind are projected to outperform it handily. Government and industry sources project 4,000 MW to 5,000 MW for new solar capacity and 5,000 MW to 8,000 MW for new wind power.

The driving force behind this is partly a gradual reduction in the costs of new renewable generating capacity and the subsequent reduc-

Cont'd on p.14

It MOWS ...YOU Don't!! A Huge Pollution Solution

By N.R. Mallery

According to the EPA, gas-powered mowers produce 5% of the US air pollution. Each weekend, nearly 54,000,000 Americans mow their lawn. They use 800 million gallons of gas per year, and produce millions tons of air pollutants, including 8.8 million tons of carbon dioxide. Just filling the mowers, they spill about 17 million gallons of oil and gas – more than the Exxon Valdez – each year. These pollutants include carbon monoxide, volatile organic compounds and nitrogen oxide. A new gas-powered lawnmower produces as much in organic compounds and nitrogen oxide emissions of air pollution, per hour of operation, as eleven new cars.

Lawn mowing is a chore that would be a waste of time, if we did not find it necessary. We spend a lot of time on it that might be better spent working on the garden or our homes. In fact, most of us would much rather ride a bike, go swimming, go fishing, or relax at home.

Well, there is an awesome solution for all of these problems. And I can tell you a story about it.

It all started when I was given a gift of a robotic vacuum cleaner. I had used it for a year and a half, when a friend, watching my little robots clean, mentioned to me that they also make robotic lawnmowers.



This lawn was a former cow pasture. No fertilizers, no seeding, and no ammendments, except the mowing. The owners have stopped mowing the lawn -- and let this robot mower keep it looking like a golf course. Photo: N. R. Mallery.

This led to a lot of research, and I was amazed at what I found. In fact there are many models of robotic lawnmowers available today. Beyond that, however, they are not merely gimmicks. They have real value, in terms of health, economics, and for the environment.

I have a large lawn at my off-grid solar home. Reading through reviews, I could see that not all mowers would be suitable on my property. As I continued to do research,

Q: What's wrong with this picture?

A: No Handle!

Q: What else is missing from this picture?

A: No YOU!

I found what looked like the best option for me, Robomow's Friendly Home lawnmower.

The outcome is that I no longer mow my lawn. And my lawn always looks pristine – always! My lawn, which was once a cow pasture, looks like a golf course – all the time! All I did was to set up a perimeter wire, set the base charging station, select my parameters and press GO. And it is been mowing the lawn regularly ever since.

Now, neighbors stop by to take pictures or just to watch my lawn being mowed. It seems they can't believe their eyes. When they ask whether the little machine really did all of this nice work, I smile and nod yes!

The Robomow is quiet. It works 24/7,

Cont'd on p.39

Energy-Positive Homes Are Transforming the Building Sector

By R. Carter Scott

Buildings account for about 42% of the carbon emissions in the United States. The transportation sector uses another 25%. Why not use the building sector to drive down its emissions as well as those of the transportation sector?

With the concentration of carbon in the atmosphere surpassing 402 parts per million – and rising at more than 3 parts per million in the last year alone – our society needs to change, if we want to continue living on a planet that we have grown accustomed to.

Building homes that produce as much energy as they consume is not a difficult task. It has been done cost-effectively for eight years in New England. Building homes that also produce surplus energy for its occupants' transportation needs is also not difficult. This has been done since 2012. The task at hand is to "scale up" the knowledge and practices, so that this is the standard practice everywhere.

California has mandated that zero energy be the standard for new residential construction by 2020 – the first in the nation to do so. In Massachusetts, we should

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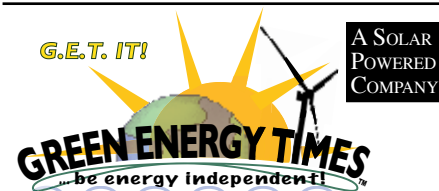
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follow their lead and have all new residential homes here built to the zero energy standards by 2025 – that would give us nine years to make the transition. Maybe some other New England states can join our efforts for 2025 such as

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Green Energy Times is produced by 100% solar power, off-grid with a 3.8 kW PV system. We live and know that Energy Independence is indeed possible - with clean, sustainable renewable energy along with reducing your needs. We walk the talk! **Our mission is to create Energy Awareness, Understanding and Independence - Socially Responsible Living.**

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LATE BREAKING NEWS

As we go to press, we see two important news items.

First, the United States Supreme Court has decided to leave the Environmental Protection Agency's regulation on mercury emissions from power plants intact. Twenty states had sued over the regulation.

This is particularly important. Until recently, mercury levels in our environment had been on the increase because of burning coal. There is no practical technology for removing mercury from the environment, but it can accumulate in a food chain, producing health-threatening levels. Some states have web pages providing information on how much wild fish can be safely eaten from waters in the state. This is particularly important for children, as mercury attacks the nervous system, doing permanent damage.

Also, an analysis of new data from the Department of Energy's Energy Information Administration highlights a fact some people will find very surprising. Electricity from all renewable sources provided 19.2% of the country's demand in March. It was nearly equal to the output of all nuclear plants.

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Energy Awareness, Understanding & Independence!

Transforming Energy Use in New England

By Alan Betts, <http://alanbetts.com/writings>



It has been an unusual spring. After a warm winter, the early daffodils bloomed in late March here in Vermont, but their blooms were killed by

a very heavy frost in April. But spinach and lettuce that overwintered survived that severe frost, and so did hardy seeds including peas that I planted around the beginning of April. As a gardener I adapt to change.

Awareness is spreading in New England that our entire energy system must change, so what do we need to do? We know how to retrofit our houses so that it take less energy to heat them in winter. Energy teams can go through your home and add insulation, seal up the doors and replace old windows. I was pleasantly surprised how comfortable my old house on a hill became without drafts! We know how to build net-zero houses for new construction – essentially buildings that are so well sealed that they use air-to-air heat exchangers to ventilate the home, and transfer heat from exhaust air to the cold incoming air in winter.

The transformation of our electrical energy system to renewables is under way. Solar panels on houses, shared community solar arrays, and many multi-megawatt arrays are feeding the grid. I now enjoy looking at my electric bill every month, and seeing the large credit from the 5kW of solar power that I purchased from a community array. Electrical storage for the grid is about to take off with the rapid fall in the price of batteries driven by the electric car firms like Tesla. Much of what is needed could

be largely completed in less than ten years if we made the effort. Yes, complaints are increasing from those that don't like to see solar panels everywhere, but the long-term benefit to society and the Earth is immeasurable. We could do better with more thoughtful community planning, but US society has traditionally preferred the freedom of this somewhat chaotic entrepreneurial growth.

It is time to tackle transportation, which uses so much fossil fuel both in a rural states and in urban areas. Industry would like us to buy a lot of electric cars, so we can continue to commute alone. Electric cars with a 200-mile range at a reasonable cost should be available by the end of this year, and they will help. But we should think about how to start the shift from using heavy single-occupancy-vehicles to get around. We have not made a change this big for a century, when trains and then automobiles replaced horse and buggy.

Uber has shown how taxi services can be improved by networking. Now we need networked passenger vans and private cars on our highways, so that I can easily share rides between my home in Pittsford and Burlington. It seems that this would not be difficult to set up. China is leap-frogging over Uber, and developing a broad Web-linked transportation system.

Another revolution would be lightweight electric vehicles, derived from tri-cycles, rather than cars. Add an all-weather aerodynamic shell, and with only 10% of the weight of a car, it is much easier to get adequate range using lithium batteries. Yes, commuting would be a little



Electric-assist tricycle with solar panel on roof. Photo courtesy of Organic Transit.

slower, as they are currently limited to about 20 mph, unless the rider pedals as well, when they can go faster. However, the cost in both dollars and damage to the Earth is far less.

One fringe benefit of using an electric trike to commute would be that exercise improves health and productivity. Our sedentary existence is a huge drain on our physical condition and medical finances. We should start planning and building a real bike networks in our cities and across New England, so these lightweight efficient vehicles do not have to share the highways with trucks. In Europe, Germany has started down this path.

Globally, tens of millions of electric bicycles and tricycles are now sold annually, but this county is largely ignoring this shift. We dream of 'solving' climate change without really changing the way of life that created it!

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

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Thoughts on the Future of Renewable Power

By George Harvey

Most of the states in the Northeast are struggling with net-metering, and especially caps limiting the amounts of power utilities must buy under the plans. Maine has failed on net-metering legislation. New Hampshire raised its cap, but the fix is clearly only temporary. Massachusetts also raised its cap, allowing a backlog of applications to be processed, but the new limit was reached within two weeks. The Vermont legislature is struggling with increasingly confusing attempts to set new standards. Only in New York do we see a state in the Northeast that looks serious about increasing its renewable capacity.

Net-metering caps are specifically designed to limit growth of renewable power. The main reason for them is the idea that net-metering is somehow unfair to general consumers or utilities. It is clear to us at Green Energy Times that net-metering can be made fair for everyone without any cap at all.

Net-metering means that "prosumers," who both produce and consume power, can "bank" their excess production by supplying



Pika Energy's T701 wind turbine.

Courtesy Photo.

it to the grid, for use at a later time, when need arises. This should actually reduce costs for utilities and bills for everyone if the system is correctly designed.

Many states mandate prices paid to prosumers for excess power that are above retail, to encourage adoption of renewable energy. In other states, net-metered power earns a rate below retail. What is fair is a matter of debate. Properly managed, small net-metered power generators can reduce transmission costs, increase grid stability, increase grid security, and reduce demands for water. These are

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THE ENVIRONMENTAL IMPACT OF THE VW EMISSIONS CHEATING SCANDAL

An analysis by The Guardian last September 2015 revealed that affected Volkswagen diesel-engine vehicle in the U.S. are likely emitting between 10,392 and 41,571 tons of toxic nitrogen oxides (NOx) into the air every year, based on typical annual mileage counts. If those vehicles had complied with federal pollution standards, they would have emitted just 1,039 tons per year. Researchers believe Volkswagen has added between 10 and 40 times more NOx pollution into our atmosphere than the U.S. Environmental Protection Agency (EPA) considers safe for people to breathe. According to the Guardian, the 11 million affected diesel-engine VWs on the road worldwide could be emitting some 237,161 to 948,691 tons of NOx emissions annually. In contrast, Western Europe's biggest electrical power station emits just 39,000 tons each year.

A study released in October 2015 by public health researchers from Harvard and MIT found that 59 Americans will die prematurely from the excess pollution caused by Volkswagen having cheated on emissions tests in the U.S. Researchers calculated the amount of extra particulate and ozone pollution put out by the rigged vehicles between 2008 and 2015 to arrive at their conclusions—and recommend that VW prevent another 130 early U.S. deaths by recalling all affected cars in the U.S. by the end of 2016. The health implications in Europe are even more troubling given that half of the passenger cars on the road there are diesels (including eight million affected VWs), compared to just three percent in the U.S.

According to a tentative deal reached between the U.S. government and Volkswagen in April 2016, Americans may be able to breathe a sigh of relief soon. VW tentatively agreed to compensate some 500,000 U.S. customers who own two-liter diesel-engine vehicles (including certain Jetta, Golf, Beetle and Passat models) that were rigged to cheat emissions tests. While details are not finalized, VW reportedly has committed to either

buying back or fixing the cars to meet emissions standards and providing "substantial compensation"—\$5,000 each is rumored—to affected car owners. This deal doesn't apply to the 90,000 three-liter diesel-engine vehicles in the U.S. implicated in the scandal, let alone the 10 million-plus other affected vehicles worldwide, but it does establish a precedent and some guidelines which should direct VW's compensatory efforts moving forward in Europe and beyond.

Environmental groups aren't letting Volkswagen off the hook just yet, and not only because the company hasn't agreed to any specifics yet. "The final settlement needs to fix or remove all of the polluting cars still on the road, make whole the consumers who trusted the vehicles were lower-polluting, and compensate for the pollution the faulty cars created," says Kathryn Phillips, the Sierra Club's California director. It's unclear if there is any nod to Phillips' last requirement—a key sticking point for greens intent on not letting the German automaker off the hook—in the still unreleased agreement.

For its part, VW isn't taking the scandal lightly, recently announcing that it was setting aside \$18.2 billion—more than double the amount it originally anticipated—to help fix the situation amid an environment of overall declining sales. We hope VW is now committed to solving the problem and will stay on the right side of regulators moving forward. But who knows how many other large industrial companies are skirting rules and spewing dangerous levels of pollutants into our skies, land and water?

Contacts: "VW scandal caused nearly 1m tons of extra pollution, analysis shows," *The Guardian*, <http://bit.ly/1MostqE>; "Impact of the Volkswagen emissions control defeat device on US public health," *Environmental Research Letters*, <http://bit.ly/1WLgj1C>; *Sierra Club*, www.sierraclub.org.

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Volkswagen is ponying up \$18.2 billion to deal with its emissions cheating scandal, but environmentalists wonder if all the money in the world will be able to save those already negatively affected by the pollution and the wound to consumer confidence. Credit: Roddy Scheer.



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Electric Cars – Easy as 1-2-3

By David Roberts



The Ford Fusion Energi PHEV is currently leasing for \$139/mo with \$3,200 due at signing. Courtesy photo.

Plug-in electric cars are widely available in the Northeast. With 20 models in dealerships across the region, the chances are good there is at least one that could fit your household's needs. We've put together this summary of the top three things to consider the next time you're in the market, including types of electric cars, charging and affordability.

1. There are two types of electric cars

All Electric Vehicles (AEVs) are powered solely by a battery, such as the Nissan LEAF, Tesla Model S, Volkswagen e-Golf and others. Official range estimates vary by model from 80-270 miles before recharging is needed. Range is significantly reduced by cold temperatures, but vehicles are designed to be able to handle most individual daily travel needs in all kinds of weather.

Plug-in Hybrid Vehicles (PHEVs) powered by either battery or gasoline, such as the Chevrolet Volt and Ford C-Max Energi, which can travel 15-50 miles on the battery before seamlessly switching to gasoline for extended range. PHEVs are a great option for people who are concerned about range.

Depending on the vehicle, travel patterns and charging availability many PHEV owners are able to travel more than 80% of their miles on electricity.

Knowing which type of electric car will fit your lifestyle and driving needs will help you narrow down to specific models to research and try out.

2. Charging electric cars is easy

Both types of electric vehicles charge at home by plugging into standard 120V outlets using equipment that comes with the cars. Faster charging is available by upgrading to a 240V charger (like an electric clothes dryer circuit). In addition, many workplaces are installing charging stations for employee and visitor use. A growing network of public charging stations makes it more convenient to travel longer distances for AEV drivers, especially as new fast charging locations come online which can charge most models of AEVs in about 30 minutes. PHEV owners can charge when they like, but can run on gasoline for as long as they need.

3. Electric cars cost less than you think

Electric car ownership costs are very competitive with similar gasoline-powered vehicle counterparts. Most drivers start saving on gasoline and maintenance right away compared to a gasoline vehicle they are replacing. There are also federal and state incentives available which reduce the purchase or lease costs of electric cars. The federal tax credit of up to \$7,500 is based on the size of the electric car battery. State level incentives are summarized in the table below, with several states offering up to \$3,000 in addition to the federal tax credit.

STATE	ELECTRIC CAR INCENTIVE	WEBSITE
Connecticut	Up to \$3,000 off purchase or lease of eligible electric cars at auto dealers	www.ct.gov/deep/CHEAPR
Maine	No consumer incentives available	www.gpcos.org/energy/maine-clean-communities/incentives/
Massachusetts	Up to \$2,500 rebate on purchase or lease of eligible electric cars	www.mor-ev.org
New Hampshire	No consumer incentives available	www.granitestatecleancities.nh.gov
New York	Incentive program offering up to \$2,000 for electric cars arriving in fall 2016	www.nyserda.ny.gov/Cleantech-and-Innovation/Electric-Vehicles
Vermont	Up to \$1,000 incentive available at participating auto dealers	www.driveelectricvt.com/buying-guide/incentives



Automakers also have their own incentive programs which can add even more savings to the pot.

Leasing is an especially popular option for electric cars as leases usually include at least a portion of the above mentioned incentives to reduce monthly and upfront payments. Many electric cars are now leasing at dealers for \$200-\$300/month. Lessees have the option to purchase at the end of their lease or they can return their vehicle and move up to the latest electric car technologies. They also don't need to worry about depreciation of their investment as new models arrive.

There are also many models of used electric cars available at prices that are very competitive with gasoline options. These are frequently coming out of leases with low mileage. These can be a great option for people who aren't sure about leasing

or want the best deal possible. Like any used vehicle purchase, we do recommend having vehicles inspected by trained service technicians before purchasing to ensure the battery and other vital components are in good condition.

Many states are also offering non-monetary incentives in addition to the federal tax credit, such as carpool lane access, reduced inspection fees, parking benefits and more.

Visit the links in the state incentive table below to learn more about what incentives are available in your area for vehicles and charging equipment.

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



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GO! VERMONT is a *free resource* for commuters who want to reduce the cost and environmental impact of driving. The program features a carpool/vanpool matching service and lots of practical information about other ways to get around.

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SMART COMMUTING IN NH & VT

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

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

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

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

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

IN NEW HAMPSHIRE

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

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

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

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

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

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

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

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

IN VERMONT

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

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

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

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

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

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

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

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

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

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

MARBLE VALLEY REGIONAL TRANSIT - For Rutland, Killington, rural Manchester, 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 riderrct.org

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

HANOVER, NH ADOPTS C-PACE FINANCING

-- APPROVED AT ANNUAL TOWN MEETING --

Hanover, NH - New Hampshire's Commercial Property Assessed Clean Energy (C-PACE) Finance Program is ready to help commercial building owners finance energy efficiency and renewable energy projects now that Hanover is leading the way. As the first New Hampshire municipality to adopt RSA 53-F, Hanover established the entire town as an Energy Efficiency and Clean Energy District.

C-PACE makes it possible for private owners of commercial properties (including non-profits) to obtain affordable, long-term financing for energy efficiency and renewable energy projects, by electing to repay their loan through a Special Assessment tax from the Town.

Private capital providers, such as banks and investors, can finance projects with commercial building owners and utilize the C-PACE framework. Municipalities simply act as a conduit for the repayment of

the loan and building owners and capital providers can benefit from the tax status of the C-PACE special assessment. Through C-PACE, municipalities can help support investment in commercial building improvements without cost to taxpayers.

The Jordan Institute, Inc., as the statewide administrator of the program, is currently working with the cities of Concord, Portsmouth, Dover, Keene, and Lebanon to adopt C-PACE in the coming months.

Modeled after municipal betterments such as sidewalk and sewer districts, PACE financing has been adopted by 32 states and in the past few years has helped more than 700 commercial buildings across the country complete energy efficiency and renewable energy upgrades using over \$200 million in private investment.

Find out more about NH adopting the C-PACE program at www.cpace-nh.com.

Thoughts on the Future of Renewable Power

Cont'd from p.3



Revision Energy of Exeter, NH is currently installing this 640-kW solar array, the second largest in NH, with 2,100 solar modules at the former gravel pit site owned by the Town of Durham in Lee, NH. Courtesy photo.

services for which they should be fairly paid.

We have many potential sources for renewable power, and all can be net-metered when the systems are small.

- Hydro-power can be installed at existing dams that have no generating facility. Vermont, for example, could get 400 megawatts of new capacity at dams that have been already been built for purposes other than generating power. Assuming the dams run at about 66.7% of the time at capacity, this is about 40% of the state's current needs. Other states in the Northeast have similar profiles.

- There is far more potential for rooftop solar power than earlier estimates said. Six of the seven states with the greatest potential for rooftop solar, as percentages of their demands, are in New England, according to the Department of Energy.

- Solar power in urban settings includes putting solar panels over parking lots and sidewalks, floating solar farms at reservoirs, and installations on abandoned landfills and brownfields.

- While burning wood in old-fashioned stoves is very polluting, modern equipment can be very clean, and wood-gas from gasification burns as cleanly as natural gas, without fracking.

- We can use biodigesters to reduce agricultural waste, municipal waste, and other food waste, producing compost and biogas to generate electricity. One municipal waste facility serving 100,000 people in Kenosha, Wisconsin, produces more energy than it consumes, turns all incoming waste into

products that can be sold or by-products that can be released safely, and runs at a profit.

- We have a large potential for wind power in the Northeast, particularly the coastal states. It is also a viable alternative for home use; Pika Energy sells a home-scale wind turbine, the T701, that is so quiet the EPA had trouble measuring its sound because of noise from the wind blowing through a nearby field of grain.

While batteries and other storage can be helpful, the real trick to balancing renewable power is partly through "smart" grid management and partly through diversification of resources. Smart grids can manage both production and loads, keeping them in balance and providing more reliable power than we have had before. Diversification means using some of every available renewable resource.

Net-metering can be achieved in ways that are revenue neutral for the utilities, on a smart grid. One way to do this is to credit and charge prosumers rates that relate to the current spot wholesale price for electricity. Prosumers typically produce power during peak demand times, when the sun is shining, and draw it when demand is lowest, at night; they act to stabilize the grid, reducing rates for all of us.

A net-metering cap is not necessary. Grid demand should be met with renewable power for reasons that are only partly environmental. Renewable power is less expensive, more stable, more resilient, and more sustainable.

★ VERMONT LEGISLATIVE UPDATE ★ Victories for Energy Siting, Weatherization Funding, and Carbon Pollution Tax Progress

By Johanna Miller



The State House in Montpelier, Vermont. Photo courtesy of VNRC.

There were several important victories for clean energy and climate action in the Vermont Legislature this past session, including an energy-siting bill that was saved in the last minute and enacted. Here's a quick summary of three significant steps forward for Vermont's 21st century energy transition this year.

Energy Siting

Because of Vermont's commitment to greater energy independence, thousands of homeowners, businesses, schools and municipalities now enjoy stable, affordable, renewable energy. The transition has not been without stumbling blocks and some controversy, however, as more solar projects in particular dot rooftops, roadways, fields and forest perimeters.

To foster more proactively planned distributed generation, lawmakers overwhelmingly

passed S.230, the energy siting bill, in the waning days of the 2016 session. It suffered a gubernatorial veto however, when deeper, post-session legal analyses highlighted a few significant problems. One of the provisions that most triggered Governor Shumlin's veto pen was an unintended by the legislature, but de-facto, moratorium on wind projects. On June 9, lawmakers fought hard to "fix" the unintended problems with the bill, moving through thick political machinations and ultimately passing a clean bill. With Governor Shumlin's signature, that bill – S.260 – became law and it will:

✓ Require communities and regions to craft plans that will support the state's efficiency and renewable energy goals – if they want substantial deference in regulatory proceedings before the Public Service Board. The bill strikes an important balance. It will give communities and regions greater say in what projects get built and where, while ensuring that communities and regions are partners in this needed evolution. The bill also requires that regional plans allow for all forms of renewable energy, thereby prohibiting regions from saying "no" to any particular form of technology, such as wind or solar.

✓ Create a one-year "preferred locations" pilot program to foster the development of renewable energy projects in the built environment. If fully implemented, this pilot could spur 2.5 MW of new renewable energy in locations such as commercial rooftops, gravel pits, landfills, etc. Half of the 2.5 MW could be used to foster solar on parking lots as solar canopies. Because it often costs more – sometimes far more – to develop on the built environment, this pilot will test how Vermont might align state incentives to actually get these types of projects built.

✓ Initiate a two-pronged process for the Public Service Board (PSB) to set short-term and long-term sound standards for wind. The bill charges the PSB to issue temporary sound

standards (that would apply to projects proposed between enactment and July 2017). It also charges the PSB to set long-term rules related to sound thresholds that wind projects must meet to receive the required Certificate of Public Good. Those rules would be set through a thorough and participatory public rule-making process.

Low-Income Weatherization Funding

Vermont's Weatherization program – funded by a small "Gross Receipts Tax" on liquid fossil fuels and electricity – has helped many low-income Vermonters reduce their fuel burdens and further Vermont's energy efficiency goals. The funding formula for it, however, hasn't increased since it was instituted over 25 years ago – despite the opportunity it provides to save people money and create jobs. This year, lawmakers authorized a modest increase for Weatherization funding. Changes to the funding structure, applied to all sources except electricity, will infuse over \$2.5 million more annually into this successful program, helping us cut into the current backlog of projects.

Carbon Pollution Tax

Two bills that would put a price on carbon pollution – H.412 and H.395 – were introduced this legislative biennium. There was never an expectation that either bill would actually be enacted this session, but lawmakers and proponents sought to gather input on how to shape any potential carbon pollution tax. The strategy was a success. This past session, members of the House Natural Resources and Energy Committee heard from businesses, low-income advocates, faith leaders, and others about the need for a carbon pollution tax.

A growing coalition – Energy Independent Vermont – continues to work with Vermonters to shape and advance a state-based carbon pollution tax that would achieve each of the following goals:

- Grow jobs and the state's economy,
- Reduce other taxes,
- Protect low- and middle-income Vermonters,
- Substantially reduce Vermont's greenhouse gas emissions.

Find out more about Vermont's effort to put a price on carbon pollution and get involved at www.energyindependentvt.org.

Learn more about or discuss any of these issues, bills or the recent legislative session by contacting VNRC's Johanna Miller at jmiller@vnrc.org or 802-223-2328 ext. 112.

Johanna Miller is the Energy Program Director for Vermont Natural Resources Council & VECAN.

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NH PUC AWARDS FOR RENEWABLE ENERGY

NHPUC Awards Will Help State Achieve Its Renewable Energy Goals

The New Hampshire Public Utilities Commission recently awarded \$1.025 million to fund four renewable energy projects in New Hampshire. Funded by the State's Renewable Energy Fund, the grants help pay for a range of renewable energy installations which will contribute to reducing New Hampshire's dependence on fossil fuels and to achieving the state's renewable energy goals. The grant funds will be leveraged with an additional \$1.9 million in project funds invested by the grantees.

The Commission issued its annual request for proposals in September 2015, receiving eight applications with grant requests totaling more than \$3 million. Proposals were evaluated by a selection committee made up of representatives from the Commission staff, the Department of Environmental Services, and the Office of Energy and Planning. All proposals were scored, and recommendations for awards were provided to the commissioners for review and approval. The four grant agreements were approved by Governor Hassan and the Executive Council on April 20, 2016.

"This year's request for

Cont'd on p.18.

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The Andersons' Renewable Energy Adventure

By Stuart Anderson

When we built our house in Otego, New York in the late 1980s, we did lots of things right: southern exposure, long overhangs, R-45 walls and ceilings, split-frame cavity walls, sealed vapor barriers, and a roof slope of 45 degrees. After all that, pretty well spent out, we settled for oil heat and hot water.

Twenty-five years later, our heating system was aging, and oil was no longer cheap, and solar panels had come way down in price. State and federal incentives made our final decision to "go green" easy. As a very visible anti-fracking activist, I knew a number of contractors working in renewables. We looked at solar thermal and solar photovoltaic (PV), wood pellets, grass pellets, wood boilers, and geothermal heat pumps.

Given the facts, the choice was very logical. Fuel prices rise and fall, and once you're invested in a technology, it is difficult to react to market conditions. After long conversations and lots of number-crunching, we took the plunge on a 10-kilowatt grid-tied PV system, a four-ton geothermal heat pump, and a high-efficiency heat-pump-assisted electric hot water heater.

Once the decisions were made, things happened quickly. Bennett Sandler from Equity Energy did a home energy audit and sized up our heating needs. Albert Hulick from Revolution Solar measured the roof, ordered the equipment, and took care of the paperwork with the New York State Energy Research and Development Authority (NYSERDA) and New York State Electric and Gas.

From the time work started, it only took one week for the crew from Revolution to get all the panels up and wired, get the inverter and grid tie installed, and get everything inspected. Naturally, the juice flowed the right way.

A few days later the heat pump and water heater arrived, along with a lot of pipe and paraphernalia. I opened up the ceiling and wall for the pipe to the pond. Roberto Romano from Equity Energy got the new water heater plumbed and wired the same day, so we went only about eight hours without hot water. We re-used the forced-air ductwork for the new heating system, but needed a new trunk line to the upper floors for air conditioning. I got this installed, and Roberto built a new plenum to join the heat pump to the ducts. Then he assembled the pipe from the flow center to the pond, while I dug a trench under the terrace.



Rooftop solar array at the Anderson residence. Photo courtesy of Revolution Solar.

Heat pumps are three to four times as efficient as conventional electric resistance heaters, and geothermal pumps are the most efficient type. Geothermal loops can be buried in the ground to draw heat from the ground, but they operate most efficiently when drawing heat from water ten feet deep or more. That is the option we chose.

Roberto's engineer was not sure our pond was big enough, and he did not want to be responsible for making us the owners of a quarter-acre ice cube, so we expanded it to over half an acre. I rented an excavator and bulldozer for a week. I dug the new part of the pond, drained the old pond, and opened the area between them. I also deepen some shallow areas of the old pond. I swung the pond loops out to the middle and let the pond fill up. The loops floated until Roberto used a special pump to fill the circulating system with mixture of water and anti-freeze.

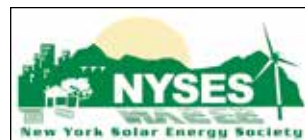
In 2014, the year before our renewable conversion, we spent \$3124 on fuel oil and \$1515 on electricity, a total of \$4679. In 2015, we only spent \$398 on electricity, for a savings of over \$4200 per year. Impressively, our home energy use is no longer contributing to climate change, because we when we need to buy what electricity, it comes from an all-renewable electric supplier.

The PV system gross cost was \$35,000, and we got rebates of \$10,080 from NYSERDA, a Federal investment tax credit of \$8,780, and a \$5,000 New York State tax rebate; so the net cost of the PV system was \$11,140. The geothermal system,

including the hot water heater and the pond excavation, had a gross cost of \$23,176, but got a \$5,814 Federal investment credit. The bottom line cost for the entire project was \$28,502; with annual savings of roughly \$4,000. This means we will break even in around seven years. Our property assessment

Cont'd on p.14

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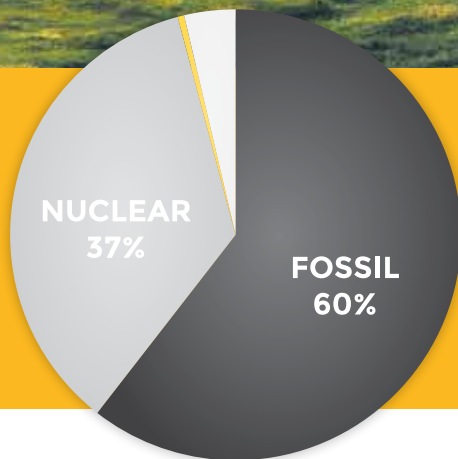
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DOES ROOFTOP SOLAR MAKE SENSE IN THE NORTHEAST?

EarthTalk® From the Editors of E-
The Environmental Magazine

Dear EarthTalk: Is it true that home rooftop solar only makes sense in certain parts of the U.S. with proper incentives as opposed to where the sun shines the most? - Esther Knox, Wilton, NH

The short answer is yes. In the United States, whether or not it is easy and economical to go solar depends more on state politics than prevailing weather trends. In those states with ample sunshine and the legislative initiative to get solar panels on residential roofs, there has never been a better—or cheaper—time to put photovoltaic panels to use.

According to Solar Power Rocks, a website that helps homeowners understand the rules, incentives and investment returns on local solar panel installations, the top three states where switching over to solar power makes the most economic sense are in the Northeast (New York, Massachusetts and Connecticut). Maryland, Oregon, Minnesota, New Mexico, Vermont and Colorado round out the top ten.

What makes these states particularly prime for rooftop solar is their willingness to allow homeowners to lease photovoltaic equipment from third-party owners (like Sun Edison, Solar City, SunRun, etc.) and legislature-backed incentives to help keep costs down overall. Going solar in one of these states might end up being cheaper than remaining on the grid.

Surprisingly, a few states in the South (Florida, North Carolina, Oklahoma and Ken-



Who would have guessed that the best three states across the U.S. for putting solar panels on the roof would be in the Northeast? Credit: Nick Normal, FlickrCC.

tucky), where solar panels would seem like a no-brainer, continue to resist this change for the better, in large part due to entrenched utility lobbies intent on maintaining their fossil-fuel-based lock on the status quo. According to a recent Rolling Stone article by Tim Dickinson, the recent ascent of solar power in the U.S. poses a grave threat to the business interests of big fossil fuel industry investors. Dickinson details how these entrenched interests are "mounting a fierce, rear-guard resistance at the state level—pushing rate hikes and punishing fees for homeowners who turn to solar power." He adds that their efforts have "darkened green-energy prospects in could-be solar superpowers" such as Arizona and Nevada. "But

Cont'd on p.23

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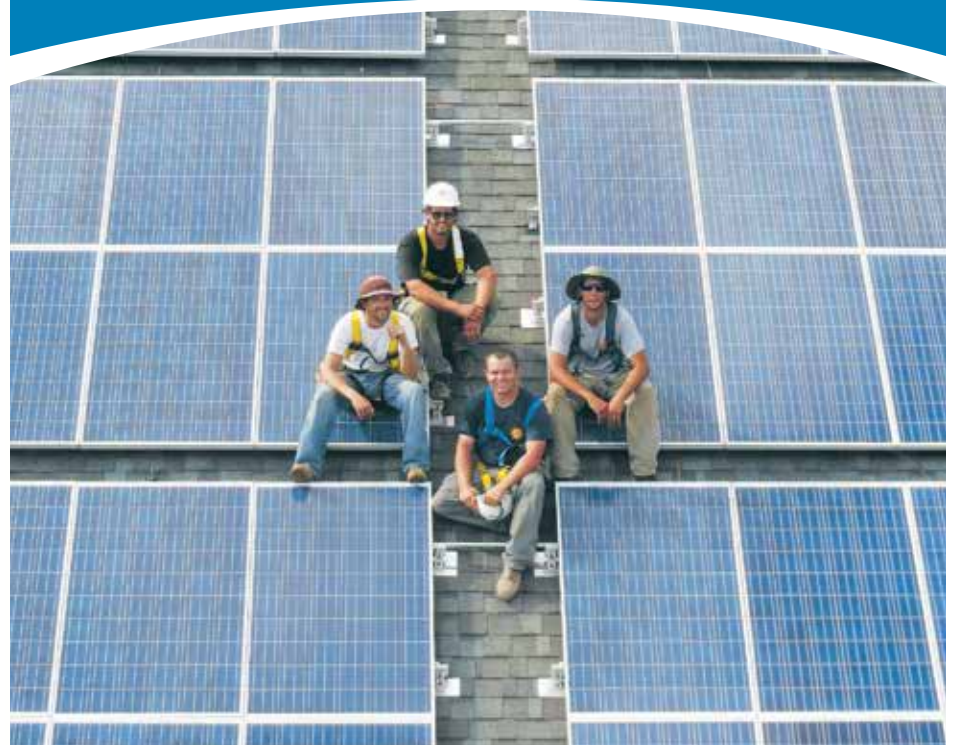


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Rooftop Solar Potential

By George Harvey

The Department of Energy's National Renewable Energy Laboratory has released a report, "Rooftop Solar Photovoltaic Technical Potential in the United States: A Detailed Assessment." Its conclusions were surprising, partly because they showed earlier estimates were far off the mark. The report can be seen at bit.ly/rooftop-solar-report.

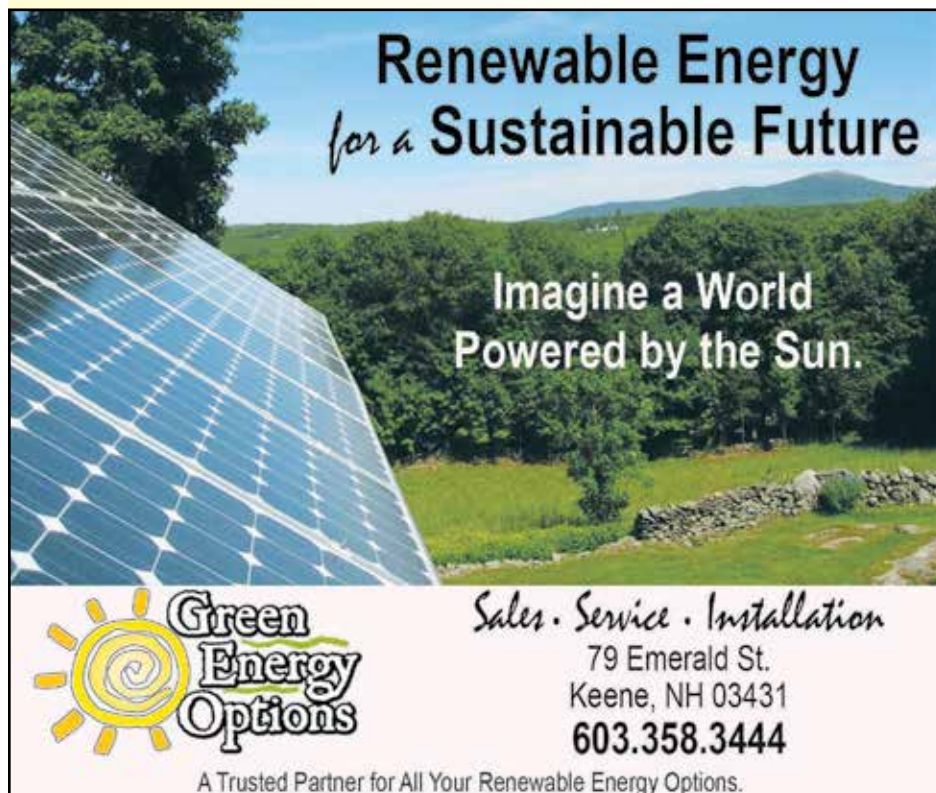
The new calculations increased significantly the estimates of the percentages of our current electrical demand that could be generated from rooftops. This is true for not only the country as a whole, but for nearly every state. But what is really shocking is which states showed the greatest values. California is rated highest, and theoretically able to generate an impressive 74.2% of its demand from its rooftops. Surprisingly, however, the next six states are Maine (60.0%), Ver-

mont (60.0%), Rhode Island (56.6%), New Hampshire (53.4%), Connecticut (49.8%), and Massachusetts (47.0%).

While our minds could go to the idea that rooftop solar could be augmented with such things as canopies over parking lots and sidewalks to fill all our needs, we should be careful not to fantasize overly. We will certainly not develop 100% of available rooftops and might be lucky to get half of that.

Additionally, we will very likely need to triple our demand for electricity, so we can cover the needs of heating and transportation without fossil fuels. If that happens, our rooftops would only provide us with 20% of the total, if they were fully built out. Also, we need diversified power sources for several reasons relating to resilience and economics, such as a winter week without sunshine.

Nevertheless, this is very positive news.



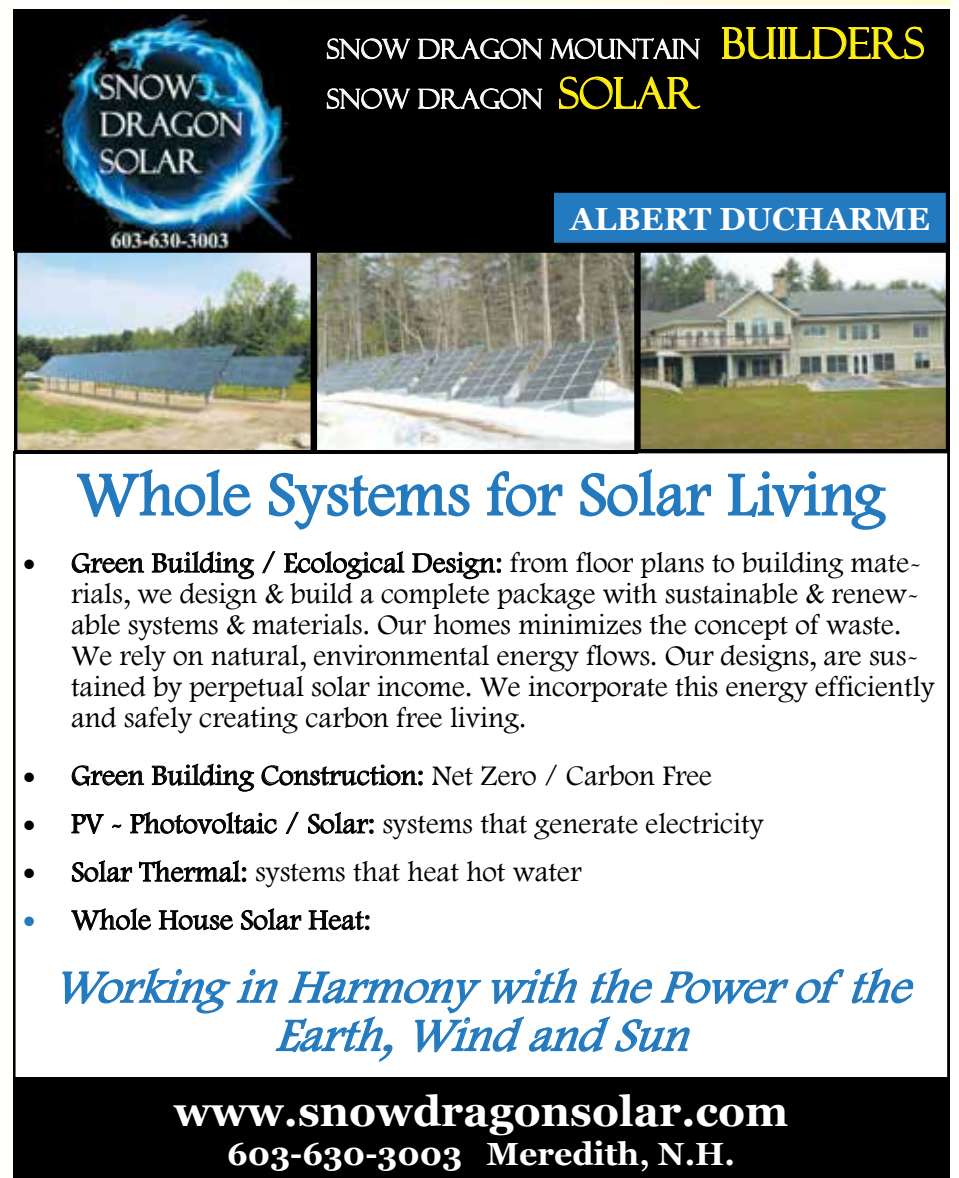
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Panasonic Reintroduces HIT® Solar Panel for Homes

by Hope O'Shaughnessy



Installing Panasonic HIT® solar panels that use 96 cells and provide optimal use of space compared to the typical 60-cell panel. Photo: Panasonic Eco-Solutions.

2016 marks the launch of Panasonic Eco Solutions North America's solar panel that incorporates the company's most innovative solar technology. The company's photovoltaic module HIT® N330 and N325 offers module efficiency of 19.7% and 19.4% and cell efficiencies of 22.09% and 21.76% respectively. These solar panels offer Panasonic's unique 'hetero-junction' solar cell for which it was recognized in 2012.

In 2012, The Institute of Electrical and Electronics Engineers (IEEE) Corporate Innovation Award recognized the achievement of Panasonic's revolutionary technology when they awarded the company the IEEE Corporate Innovation award. Other recognition has included a number five ranking overall and number one electronics company in Interbrand's 2014 annual "Best Global Green Brands" report. "The high efficiency market is going to grow and the residential market will grow as well," Mukesh Sethi, Group Manager of Panasonic's Eco Solutions Solar Products Group shared at the recent Solar PV Conference in Boston.

According to Sethi, Panasonic achieves this industry leading edge through several unique product attributes. He pointed out that the Panasonic HIT® range of solar panels use 96 cells compared to the typical 60-cell panel, which allows Panasonic's panel to make the best use of space. The company also provides a 15 year product warranty for the HIT® panels.

Another product attribute that Sethi shared is Panasonic's unique pyramid cell structure that allows higher sunlight absorption. The amorphous silicon layer also has unique property, which allows the panel to outperform other panels at high temperature due to minimal drop in performance at high temperatures. Lastly, the panels include a water drainage frame to avoid water accumulation and staining.

Panasonic brings 40 years of investment in the solar field and, with the recent R&D developments, will provide additional impetus for the U.S. consumer to adopt this technology. Panasonic sets the bar higher for its competitors as it demonstrated with the 2014 announcement in a white paper by Shingo Okamoto (Solar Business Unit, Eco Solutions Company, Panasonic Corporation) that the company had achieved "an unprecedented conversion efficiency of 25.6% for silicon solar cells without a concentrating function." It also announced in March 2016 that now it holds the record for high-

est efficiency at module level as well which is 23.8% module efficiency. This was attained at the research and development (R&D) level.

Expect more to come from Panasonic in overall sustainability as well. Another innovation visiting the U.S. market is the smart sustainable city. According to Sethi, Eco Solutions will begin work this year with the City of Denver to pioneer the first sustainable smart city in

the U.S. The Fujisawa Sustainable Smart Town in Japan is a completed smart sustainable city, developed by Panasonic and the government that includes all aspects of living and sustainability from electric-car charging stations to water consumption and ridesharing. Fujisawa was created also in response to the need to create a disaster-resistant city following the 2011 tsunami and earthquake in Japan.

You can find Panasonic solar panel information at <http://business.panasonic.com/products-solutions-solarpanels>.

Hope O'Shaughnessy is a New England-based writer who has written for western Massachusetts publications including the Daily Hampshire Gazette (Northampton, MA) and The Republican (Springfield, MA).

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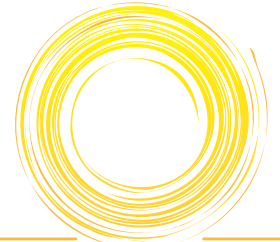
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The Andersons' Renewable Energy Adventure

Cont'd from p.8

went up, but the installation is exempt from property taxes for fifteen years. If we ever choose to sell, our tiny annual energy bill should be a strong selling point, as should the central air conditioning.

We did learn a few lessons with this project. Talk to people who have already had similar projects done. Talk to LOTS of contractors. Look into all your options, even if you already think you know what you want, you may be surprised. Talk to your local code enforcement officer. Learn to navigate the various State websites that explain how the rebate programs

work. Don't believe everything you read on the internet.

Most important, remember that old furnace will not die in July because that is not when it is used. It will die in January when the ground is frozen and the roof is a sheet of ice. Do not wait for a catastrophe!

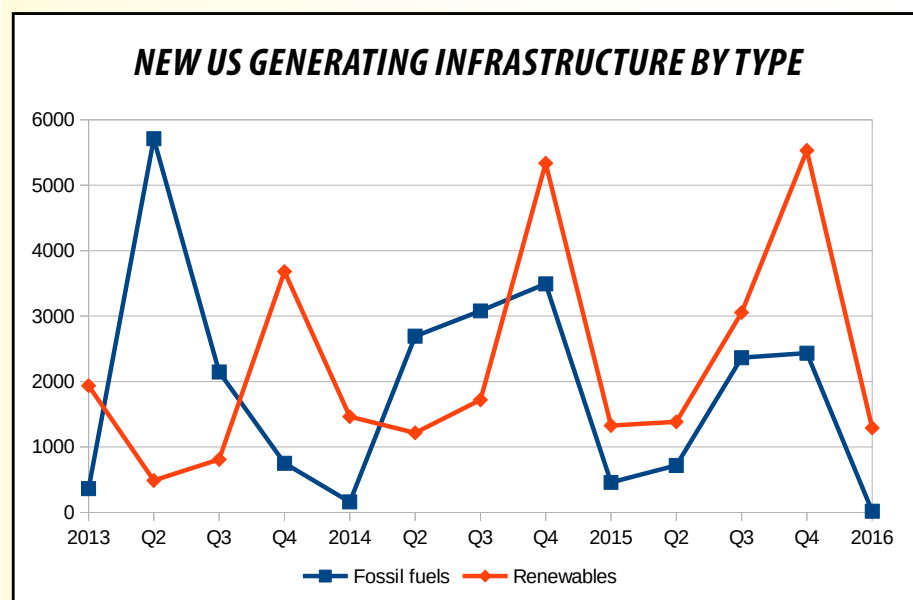
The Equity Energy website is equityenergy.net. The Revolution Solar website is revolutionsolar.com. NYSEDA's solar website nyserda.ny.gov/All-Programs/Programs/NY-Sun

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Solar and Wind Blow Away Natural Gas

Cont'd from p.1



In 2013, approximately 43.5% of all new US generating infrastructure was renewable. This figure rose to 50.8% in 2014, and 65.4% in 2015. It is projected to rise to at 75% or more in 2016.

tion in prices for power that capacity produces. It is partly that renewable capacity can be quickly and inexpensively set up. Since this is often done at the facilities that will consume the power, renewable energy reduces transmission line costs, and this further reduces electricity prices.

Computerized resource and load management has proven that solar and wind can be more reliable sources for producing energy on demand than thermal

plants, including nuclear, coal, and natural gas. That is true on a smart grid, even without storage. The costs of energy storage are in steep decline, enabling micro-grids with better security and resilience. And solar and wind power both share one highly competitive edge, which is that the fuel costs never increase.

The reduction in costs for solar and wind power is reflected in recent bids for power purchase agreements. In places where incentives and subsidies are small or non-existent the costs have become stunningly low. A recent power auction

in Mexico produced prices of power that were below \$40 per megawatt hour (MWh) for both solar and wind power, handily beating bids for natural gas capacity. In Dubai, one bid for a solar power purchase agreement covering 800 MW was below \$30/MWh. In the United States, the incentives have an effect on the bids, but even combining them with the bid costs, the result is about \$45.50/MWh for the average price of wind-generated electricity in 2014.

News of upcoming initiatives highlights the increased attractiveness of renewable power even more. MidAmerican, a subsidiary of Berkshire Hathaway, has announced plans to invest \$3.6 billion in new wind farms in the Midwest, with a goal of producing 85% of its electricity from renewable sources by 2020.

As impressive as this is, however, it

is overshadowed by the long list of big businesses in the Renewable Energy Buyers Initiative. They are pushing to install 60,000 MW of their own new renewable capacity by 2025.

The German state of Mecklenburg-Vorpommern produces 130% of the electrical energy it needs from renewable sources.

Boris Schucht, the CEO of 50Hertz, the grid operator dealing with that renewable power, says the grid can be 70% made up of solar and wind power without any need for energy storage.



Pond expansion for geothermal loop operation. Photo courtesy of Stuart Anderson.

Tracking the Sun, Not Fracking Gas

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*"EEI completed our New Franklin Elementary School energy improvements project on time and on budget. Today our energy savings on the building are over \$27,000 annually."
Steve Bartlett, Business Administrator, Portsmouth, NH School District*

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FEDERAL

FEDERAL INVESTMENT TAX CREDIT

The federal investment tax credit (ITC) for most technologies, including solar, wind, heat pumps, and fuel cells, is 30% of expenditures. For commercial geothermal generating systems, microturbines, and combined heat and power the ITC is 10% of expenditures.

USDA RURAL DEVELOPMENT PROGRAM

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

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

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

BIOREFINERY ASSISTANCE PROGRAM

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

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

- Increase the energy independence of the United States
- Promote resource conservation, public health, and the environment
- Diversify markets for agricultural and forestry products and agricultural waste materials
- Create jobs and enhance economic development in rural America

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

REGIONAL

NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

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

- Must be volunteer driven or have up to 2 full time paid staff or equiv.
- have an annual budget up to \$100,000
- "Seed" grants of \$250-\$1,000 and "Grow" grants of \$1,000-\$3,500
- Go to www.grassrootsfund.org/grants/ or call 802-223-4622 for more info.

VERMONT

CLEAN ENERGY DEVELOPMENT FUND

The Small Scale RE Incentive Program, administered by Renewable Energy Resource Center (RERC), provides funds to help defray the costs of new solar thermal and advanced wood pellet heating systems. For more information: www.RERC-vt.org or call (877)888-7372

SOLAR THERMAL INCENTIVES – PER RATED CAPACITY OF SYSTEM

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

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

Pellet Heating

- Advanced wood pellet heating systems -- \$2500 per boiler (+\$500 if an audit is completed and +\$500 if the system includes at least 20 days' worth of pellet storage).
- **Details at www.RERC-vt.org or call (877)888-7372**

VT TAX CREDITS

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

EFFICIENCY VERMONT

Lighting (must be ENERGY STAR®)

Discounted replacement lamp program:

- LED R/BR/PAR \$11 to \$17 rebate
- Globe, A, Candle/Decorative \$6 rebate
- Reduced support of CFL promotions:
- LED fixtures \$15 rebate
- LED task/under cabinet fixtures \$8 rebate
- ENERGY STAR LEDs supported by Efficiency Vermont through incentives can be found for as low as \$1.95

Home Efficiency Improvements

- improvements: air sealing, insulation and heating system upgrades - up to \$2,500 in incentives - using participating* contractors

Appliances (must be ENERGY STAR)

- Dehumidifiers - \$25 mail-in rebate
- Clothes Washers - \$40 rebate for CEE Tier 1 qualifying models, \$75 rebate for CEE Tier 2, 3 or ENERGY STAR Most Efficient
- Refrigerators - \$40 rebate for CEE Tier 1, \$75 for CEE Tier 2, 3 & ENERGY STAR Most Efficient
- Clothes Dryers - \$50 to \$400 rebate on select ENERGY STAR electric models

Heating/Cooling

- LP/Oil boilers & furnaces - \$500 rebate*
- solar hot water - \$950 rebate post installation
- heat pump water heater - \$400 rebate or point of purchase discount
- central wood pellet boilers (excluding outside wood systems) - \$2,000

- circulator pumps - \$50-\$600 point of purchase discount
- cold climate heat pump - \$300-\$400 point of purchase discount

Residential New Construction

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

Other Opportunities To Save

- Advanced Power Strips – coupons at register at participating retailers*
- Pool Pump – up to \$600 rebate on qualifying ENERGY STAR models
- Meter Loan – borrow "Watts Up" meter to measure the electric consumption of your appliances

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

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission Commercial Solar Rebate Program

Category 1:

≤100 kW AC incentive levels for PV systems:

- \$0.70/watt (lower of AC and DC) for new solar electric facilities (Step 1 application received prior to September 1, 2016);
- 0.65/watt (lower of AC and DC) for new solar electric facilities (Step 1 application received on or after September 1, 2016);
- Expansions to existing solar systems are not eligible.

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

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

(Does not include federal tax credits)

Category 2:

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

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

Contact Elizabeth.Nixon@puc.nh.gov or at (603) 271-6018.

PLEASE NOTE: Category 1 C&I Program is accepting applications for a waitlist for the funding. As of May 5, 2016, the budgeted funding for Category 1 of the C&I Program was fully reserved. As funding becomes available, applications will be processed and reviewed in the order of receipt. For Info contact: executivedirector@puc.nh.gov. For C&I solar program details, go to: <http://bit.ly/NHPUC-re-Rebates>

Residential Solar PV Rebate Program

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

Contact jon.osgood@puc.nh.gov

Residential Solar Water Heating Rebate Program

- \$1500 - \$1900 per system based on annual system output
- Maximum incentive in combination with other incentives received: Rebate in combination with other rebates or grants received from the utility or other programs, including other state, local or federal programs, shall not exceed 40% of the total cost of the system (Does not include federal tax credits).

Commercial Bulk Fuel-Fed Wood Pellet Central Heating Systems

- 30% of the heating appliance(s) and installation cost, up to a maximum of \$50,000. An additional 30% up to a maximum \$5,000 is available for thermal storage. Systems must be 2.5 million BTU or less

Wood Pellet Boiler or Furnace

- 30% of installed system up to \$6k
- Must meet thermal efficiency and particulate emissions standards

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

LOCAL INCENTIVES

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

- These are offered on a town-by-town basis.
- The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes.

Visit <http://www.nh.gov/oep/programs/energy/pace/index.htm> for more information.

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH THE NH ELECTRIC CO-OP

PLEASE Check for UPDATES With NHEC.

Commercial Solar Thermal (Hot Water)

- is 25% of the project cost up to \$20,000.

Commercial Solar PV

- \$0.50 per watt up to the lesser of 15% of installed cost or \$20,000

Commercial Fossil Fuel Program

- Incentives of 35% up to \$15,000

Residential Solar PV

- is 20% of the project cost up to \$2,500.

Residential Solar Hot Water

- is 20% of the project cost up to \$1,500.

Heat Pump Water Heaters

- is 50% of the project cost up to \$1,000.

Heat Pump Conversion

- is 35% of the project cost up to \$10,000 for Geothermal Heat Pumps.
- is \$450-\$900 per system based on SEER rating for Ductless Mini-Split Heat Pumps.
- is 35% of the project cost up to \$3,500 based on SEER rating for High Efficiency & Hybrid Central Heat Pumps.
- is 35% of the project cost up to \$25,000 based on SEER ratings for Commercial ground or air source heat pumps and ERV's.

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.

PAREI

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

- WWW.NHSAVES.COM
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NH HOME PERFORMANCE WITH ENERGY STAR

Sponsored by all NH electric and natural gas utilities in partnership by the U.S. Dept. of Energy. Fuel-blind eligibility using the Home Heating Index (BTUs of heating fuel / conditioned square feet / heating degree days). Must provide at least 12 months of heating fuel history. Once qualified, eligible homes get a \$450 value comprehensive energy audit for \$100 (rebated if improvements installed), and 50% instant rebate for eligible weatherization improvements up to a \$4,000.

Visit www.nhsaves.com/residential/ret-rofit.html for more information and an online Home Heating Index calculator

NH ENERGY STAR HOMES

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

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

NH ENERGY STAR APPLIANCES & LIGHTING

Mail-in rebates for ENERGY STAR-rated clothes washers (\$30), room air conditioners (\$20), room air purifiers (\$15) and 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 stylish lamps to hard to find specialty bulbs. Catalog includes other efficiency items such as smart strips, power monitors, and water-conserving devices

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

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

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Rebates of up to \$1,500 on high efficiency Furnaces and Boilers, \$200-\$500 rebates on Mini Split Heat Pumps, up to \$800 rebates on water heaters, rebates on programmable and Wi-Fi thermostats
Program details and application at www.NHSaves.com/heatingcooling

OTHER NH ELECTRIC UTILITY PROGRAMS

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

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

Business Programs

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

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

NH Weatherization Assistance Income-Eligible Programs

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

Visit www.nh.gov/oep/programs/weatherization/index.htm for application criteria, FAQs and local program contacts

MASSACHUSETTS

COMMONWEALTH SOLAR HOT WATER (SHW) PROGRAMS

Applicants must be served by National Grid, Unitil (Fitchburg Gas and Electric), Eversource or a participating Municipal Light Plant community.

Homeowners are eligible for a base rebate amount of the lesser of \$4,500 or 40% of the installed cost. The system may also be eligible to receive additional funding ("adders") which increase the amount of the rebate. Adders are detailed in the program manual at http://files.masscec.com/get-clean-energy/residential/commonwealth-solar-hot-water/SHW_Program_Manual_Small_Scale.pdf

Visit <http://www.masscec.com/programs/commonwealth-solar-hot-water>

MASSSAVE HEAT LOAN SHW

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

Energy Efficiency

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

ENERGY EFFICIENCY

After conducting a free residential Energy Audit, residential customers are eligible for up to \$25,000, commercial loan up to \$100k at 0% interest heat loan with terms up to 7 years to cover the following energy efficiency improvements: atticwall-basement insulation, high

efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows

Available only to utility customers of W. Mass Electric, National Grid, Berkshire Gas, Nstar, Unitil and Cape Light Compact

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

MASSACHUSETTS SOLAR LOAN PROGRAM

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

The \$30 million program, a partnership between the Massachusetts Department of Energy Resources (DOER) and MassCEC, will work with local banks and credit unions to provide financing to homeowners interested in solar electricity. DOER's program design will work with banks and credit unions to expand borrowing options through lower interest rate loans and encourage loans for homeowners with lower income or lower credit scores.

Since 2008, the solar electric industry in Massachusetts has grown into a robust economic sector with over 1,400 businesses and 12,000 workers, with enough solar electricity installed in the Commonwealth to power more than 100,000 homes.

Mass Solar Loan will continue to grow this sector, while allowing more homeowners the ability to achieve the cost savings and environmental benefits of this clean, renewable energy source. www.masssolarloan.com. The most updated loan principal buy down rate based on household income can be found at www.masssolarloan.com/loan-support-incentives.

DEPT OF ENERGY RESOURCES

Solar renewable-energy credits (SRECs) associated with system generation belong to the system owner and may be sold via the Department of Energy Resources (DOER) SREC program. Note: appropriate, approved Data Acquisition System monitoring must be utilized for PV systems >10kW 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 residential solar hot water or PV system.

No sales tax on residential solar hw or pv systems.

There is no increase in property tax assessment for residential hw or pv systems for 20 yrs.

NEW MA SREC POLICY

Massachusetts' new version of its Solar Renewable Energy Credits Program is informally being called SREC II.

SREC II prioritizes sites, however, by using an SREC factor based on the type of installation. The credits provided for energy produced by a system are calculated by multiplying the factor times a full credit value. Full credit is given for residential, parking canopy, emergency power, or community-based systems, or any other system of less than 25 kW. Larger systems get a factor of 0.9, if they are building-mounted or at least 67% of the power produced is used at the site. If a larger system meets neither of these criteria, but is built on a landfill or brown-field site, or if it is less than 650 kW, then it gets a factor of 0.8. Systems that qualify for none of the foregoing get a factor of 0.7.

http://bit.ly/Mass_SREC_II.

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

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH

Welcome to the 2016 New York solar incentive and rebate information:

<https://solarpowerrocks.com/new-york/>

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RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NY-SUN

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

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

Residential and Small Business

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

Commercial and Industrial

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

Community Solar

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

Find a Commercial/Industrial Solar Installer

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

Find a Residential/Small Commercial Solar Installer

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

Financing Options

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

Clean Power Estimator

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

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

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

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

SINGLE TURBINE PROJECT IN VERMONT

Will Help Sustain Family Dairy Farm in Holland

Dairy Air Wind Wins Bid to Provide Stably-Priced Wind Power to Vt Utilities

On May 31, Dairy Air Farm's efforts to host a single turbine wind project took a step forward with the Vermont Public Service Board's recent order authorizing Vermont Electric Power Producers, Inc. (VEPPI), to award Dairy Air Wind, LLC a "Standard Offer" program contract. Under the contract, the project will supply Vermont utilities with ap-



The proposed location for the single wind turbine in the cornfield of Dairy Air Farm in Holland, VT. Photo courtesy of Dairy Air Farm.

proximately 6,000,000 kilowatt hours of renewable electricity each year. The electricity will be generated by a single wind turbine surrounded by the cornfields of the Champney family's 450-acre Dairy Air Farm in Holland, Vermont.

In 2015, dairy farmer Brian Champney contacted Vermont-based VERA Renewables, Inc. for assistance in realizing his longstanding vision for generating wind power on his farm. The successful Standard Offer bid for a single turbine project is the result of that collaboration.

Brian welcomed the news, stating "I am excited that our piece of the working landscape can help contribute to Vermont's renewable energy economy and reduce Vermont's reliance on dirty out-of-state fossil fuels. At the same time, this project also helps achieve another important Vermont goal—keeping small farms like ours afloat in the face of low milk prices. I've had positive responses from many of the people I've talked to in our community, and I look forward to gathering more input and continuing to answer questions about our proposal as we move forward to make this dairy farm a wind farm too."

Under Vermont law, the Standard Offer Program enables small-scale renewable energy projects like Dairy Air Wind to secure long-term, stably-priced contracts with Vermont's electrical distribution utili-

ties in a competitive bidding process overseen by VEPPI. The power is then allocated to each of Vermont's utilities based on their pro rata share of Vermont's retail electricity market. Renewable Energy Credits (RECs) generated by Standard Offer Projects belong to the Vermont utilities buying the renewable energy

and will qualify for their Tier II Renewable Energy Standard requirements under state law.

In response to the news, Vermont renewable energy entrepreneur David Blittersdorf, who is partnering with Dairy Air Farm and VERA Renewables to develop the project, stated "This is an exciting opportunity to help local landowners sustain their family-run dairy farm by generating renewable energy in a low-impact setting while contributing substantial tax revenue to the town, and fueling the state's growing renewable energy economy." The single-turbine project "will create local clean energy and pay local taxes and state education taxes—it's a wind win-win," he added.

The Standard Offer program's purpose is to encourage development of renewable energy resources within Vermont, as well as the purchase of renewable power by the state's electric distribution utilities. Vermont law directs the Public Service Board to administer the Standard Offer Program to help the state achieve its ambitious renewable energy goals.

The project will require Certificate of Public Good approval from the Vermont Public Service Board before it can be built. The project team is in the early stages of gathering data to inform the design and permitting process and will be out in the community early in the summer.

NH PUC AWARDS FOR RENEWABLE ENERGY

Cont'd from p. 7

proposals gave special emphasis to projects that employ technologies not eligible for rebates and that increase the supply of thermal Renewable Energy Certificates, (RECs), to help reduce the need for Class I Thermal alternative compliance payments into the renewable energy fund," stated Karen Cramton the Director of the PUC's Sustainable Energy Division. "We are excited to work with this year's grant recipients on their innovative renewable energy projects."

Grants were awarded to:

Pemi-Baker Cooperative School District - \$325,000:

The school district will install a dry wood chip-fired biomass boiler at the Plymouth Regional High School. An energy efficiency performance contractor will purchase and install the boiler through an energy performance contract and will also implement a range of energy efficiency measures through this cost neutral loan. The project is expected to displace 60,000 gallons of heating oil per year, reduce carbon dioxide emissions by 552 tons per year, and generate 1,909 Thermal Renewable Energy Certificates per year. Total project cost is \$1.1 million.

Ever Better Hydro, LLC - \$200,000:

The Company will recover, reactivate, and operate the 415kW hydroelectric generating station located in Pittsfield, NH. The estimated 1.4 million kWh of electricity generation per year will provide Ever Better Eating (Rustic Crust) with approximately two-thirds of their total annual electric load across two locations in Pittsfield while avoiding 511 tons of carbon dioxide emissions annually. The facility is expected to create 1,400 Renewable Energy Credits annually. Total project cost is \$600,000.

University of New Hampshire - \$200,000:

The University will install and operate a 200kW steam turbine generation unit in Rudman Hall. The steam is generated at the University's combined heat and power plant which burns landfill gas – a renewable energy source.

The estimated 600,000kWh of electricity generation per year from waste steam will avoid 219 tons of carbon dioxide emissions annually. The facility is expected to create 402 Renewable Energy Credits annually. Total project cost is \$600,000.

Froling Energy, LLC - \$300,000:

The Company will install a dry wood chip-fired biomass boiler and a continuous feed wood chip drying facility for increasing production of Precision Dry Wood Chips (PDCs) at its site in Peterborough, NH. The project is expected to displace 93,000 gallons of fuel oil per year and reduce carbon dioxide emissions by 888 tons per year and generate 3,186 Thermal Renewable Energy Credits per year. Total project cost is \$627,000.

"These grants benefit New Hampshire by providing funding to projects that will increase the use of clean, indigenous, renewable resources, reduce reliance on imported fuels, and reduce greenhouse gas emissions," notes Cramton. "The projects will also stimulate the economy by investing dollars locally and creating jobs."

Contact: Amanda Noonan, Director of Consumer Services and External Affairs Public Utilities Commission. (603) 271-2431.



University of New Hampshire's main campus in Durham, NH. Image: Wikipedia

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Incorporating Permaculture Practices into Your Business

By Ryan Hvizda

Permaculture is quickly becoming a word that no longer results in blank stares, and now sparks a light in those that believe in sustainable living and being. Typically when one first starts to learn about permaculture, it is through the garden design process. The garden is a great place to implement this design process. However, I want to bring the focus on the three permaculture ethics, people care, fair share and earth care, and how you can design your business model to bring permaculture to life beyond your garden beds.

Strong ethics and values, rooted in the three ethics of permaculture - people care, fair share, earth care - can and do result in abundance. At face value, people think that the ethics of permaculture have no place in business, as they are not compatible with the profit-above-all model traditionally associated with businesses.

People Care

In a capitalist economic system, profits take precedence over the well-being of the people working with a particular business. In a business model that embodies people care, the priority of well-being should be a focus for each person involved in the company, the people that the company serves. This starts with the goals-articulation process for each person in your business and for your customers. One of the most important lessons I learned was from Lauren Chase-Rowell, a permaculture

Permaculture Ethics

Earth Care



Fair Share People Care

Image from <http://bit.ly/lonnie-gamble-slide-show>

ulture educator and practitioner of over 45 years, and that is that permaculture starts with you. When you honor your own goals and those of the people you work for, your ability to create a positive change in the world will be increased.

Fair Share

Giving back or employee-sharing is contrary to how most business models work (e.g., CEOs earning hundreds of times more money than employees). There is a new model in profit-share emerging between employee owned business models and profit sharing. Profit sharing models benefit all levels of a company, ensuring that not one person or select group of people is benefiting from the work of many.

Investing back into people who helped grow your company is an important tenet of fair share. What does it mean to "invest back"? A simple way to implement this is to incorporate wellness programs, service projects, coaching, education, training, and creating enjoyable and sustainable office spaces as a way to reinvest profits back into your company, and the people that work for you.

Earth Care

To incorporate permaculture into your business, it's not just about caring for people -- it's about taking good care of the earth that sustains us. Making environmentally conscious decisions can be costly, especially when businesses are expanding. Businesses tend to focus on short-term gain, but long-term longevity depends on taking care of the earth. Why aren't we asking whether this is a benefit to everyone in the future? This should be a fundamental question that any business asks. This at-

tracts the right kind of people who are passionate about helping the company succeed.

Bringing it all together

Looking at the big picture, people don't work with you because of you, but because of the standard you represent. When your business embraces the permaculture ethics in its mission and model, you will find that your business will start to evolve towards an abundance similar to your perennially designed garden!

Ryan Hvizda, realtor and co-founder, The Hvizda Team LLC, Keller Williams Realty Metropolitan. With experience in farming, permaculture, visual arts, education, and community organizing, Ryan found that her passion for sustainable living and community building was well positioned to the world of real estate. Ryan's vision is to build new communities that emphasize her values of sustainability, environmentalism, and permaculture design.



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Sustainability Shines in the Mt. Washington Valley

By George Harvey

Solar power was a little slow to get off the ground in New Hampshire because of a combination of factors. One was a generally unsupportive set of policies of the state government, though these have been partly addressed in the last few years. Another reason for the slow start was the common prejudice against solar power, based on the idea that New Hampshire is too far to the north and too cloudy to make efficient use of photovoltaics (PVs).

Nevertheless, solar power has been taking off in New Hampshire. This began slowly ten years ago, but it is clearly evident in some places, such as the Mount Washington Valley. People in that area, appreciative of the frugality involved in getting heat and power without spending money on fuel, were among the early adapters.

In 2006, the Tin Mountain Conservation Center, in Conway, became one of the first in the valley to adopt solar power. It has a solar thermal system that provides 75% of its heat, with the rest coming from locally harvested wood. In addition, solar PVs provide all of its electricity. The center has been a net-zero energy user from 2006 until recently. Now, a new building has increased the amount of power the center uses, but that is getting its own power to make it net-zero as well.

Other outdoor and environmental organizations followed in the conservation center's footsteps. The Appalachian Mountain Club uses solar, small wind turbines, and hydro for its hut system in the area. Also, in the spring of 2015, a PV system was installed by the Mount Washington Observatory's Weather Discovery Center in North Conway.

One of the most impressive systems in the area was a municipal project belonging to the North Conway Water Precinct. Its solar PVs were installed in 2011. In addition, the precinct has a geothermal system consisting of 16 wells, each 500 feet deep; these were installed in 2011 at a cost of \$1.1 million.

The declining prices for solar panels and a more hospitable political environment brought more installations for commercial operations. The Seavey Street Laundromat went solar in 2010; this promises an impressive savings in energy, when you consider the amount of hot water used for washing clothes. In 2011, the Conway Daily Sun installed rooftop panels for a thermal system. A similarly sized system in the same community was installed in 2012 at the Office Market. Also in 2012, Conway Pines installed a PV system to support its 32-unit affordable rental apartments. Badger Realty installed its solar PV system in 2013.

The movement begun at the Tin Mountain Conservation Center was



Tin Mountain Conservation Learning Center in Conway, NH. Photo: Donna Marie Dolan

pushed forward when members founded the Tin Mountain area Renewable Energy Initiative. The initiative's website makes it clear that this was modeled to a large extent on the very successful neighbor-helping-neighbor community project of the Plymouth Area Renewable Energy Initiative (PAREI), based in Plymouth, New Hampshire. This, in turn, was based on the tradition of barn-raising in communities in much of the United States. These programs install solar energy systems, both solar photovoltaic and solar thermal, at the homes of people in the nearby areas. The Tin Mountain initiative's web site is tinmountain.org/program-descriptions/tmrei. PAREI's Energy Raisers' page is plymouthenergy.org/raiser.html.

Another way the Mt. Washington Valley region is acting sustainably is with the many businesses which offer local goods and food. Old Village Bakery in North Conway, a neighbor to Seavey Street Laundry, offers fresh goods which are all made from scratch using local ingredients. A great place to visit is The Other Store in Tamworth, NH. This unique shop is a hardware store with a café which offers home cooking with fresh, local ingredients.

We should note a number of communities that have appeared in pages of Green Energy Times in the past. A solar array of 944 kilowatts was recently installed in Petersborough, NH. Franklin, NH has purposely set itself on a path toward sustainability through permaculture.

In other states, the movement still continues. In Vermont, Norwich's, municipal offices are entirely powered by renewable electricity, with the renewable energy

credits being retired by the town. Montpelier continues to make progress toward having 100% of its energy come from renewable sources. Rutland is working on its goal of being the Solar Capital of New England, with help from Green Mountain Power. Burlington was the first sizable city to get 100% of its power from renewable sources.

Greenfield, Massachusetts is getting nearly 100% of its power from renewable sources. A number of communities in New York and elsewhere in the Northeast are moving toward getting all their power from renewables as well. One secret here was allowing community choice programs to function in the states.

We at Green Energy Times take great joy in our neighbors' efforts to move away from our common destructive past, which seems to hold so many people hostage. As they do so, they are moving into a more sustainable, fossil-free future, in which the environment benefits from a reduction of the amounts of poisons to which it is



Frase Electric crew installing PV on the Lanoie barn. Courtesy photo.

exposed, our health benefits from the reduction of pollution we breathe and drink, our wealth benefits from reduced costs, and our society benefits from positioning itself by building the local economy into a self-sustainable system.



North Conway Water Precinct. Courtesy photo.

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New York's First Community-Shared Solar

...and more sustainable projects in the works!

By George Harvey



Panels in blue show the project layout for the Halfmoon community solar array.
Photo: EnterSolar

and services, protect the environment and create new jobs and economic opportunity throughout New York State," according to the program's web page, ny.gov/programs/reforming-energy-vision-rev.

REV provides residents of the state with an option for off-site net-metering. This means that it provides opportunities for people to have their own solar power, even if they do not own a place to put solar panels. Those who rent apartments, own condominiums without solar access, or have roofs that are always in the shade can invest in solar

systems in other places, and receive credit for the power the systems produce on their power bills. REV, however, does not exclude others. Under the program, homeowners, businesses, schools, and others may join in, as well.

The state is organized into zones by the New York Independent System Operator (NYISO). REV users must be in the same zone as their off-site project and served by the same utility. A map of these zones can be seen at bit.ly/nyiso-load-zone-map.

Halfmoon Community Solar

The first shared renewables community solar project in New York State was announced by the New York State Energy Research and Development Authority, New York State Department of Public Service, EnterSolar, and Clean Energy Collective. The Halfmoon Community Solar Project will provide power to New York State Electric & Gas Corporation (NYSEG). It is large enough for over a hundred customers. They must live in NYSEG's Capital Region territory, which includes parts of Columbia, Essex, Rensselaer, Saratoga and Washington counties.

The Halfmoon project is specifically for renters, homeowners and low-income residents. It will include more than 1,700 panels in an array in the Town of Halfmoon. It is expected to be completed by late summer and will generate an estimated 741,230 kilowatt-hours annually, sufficient to power 103 average-sized New York homes.

Speaking of the project, Paul Ahern, President of EnterSolar, said, "EnterSolar could not be more proud to be part of this notable project for New York State. This partnership is a model not only for solar in



Halfmoon ground breaking on April 27th. Photo: EnterSolar

New York, but nationwide."

NYSEG customers interested in this program can visit Halfmoon.RooflessSolar.com or call (844) 232-7253.

Cont'd on p.25

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Geothermal Pool and Water Heating SAVES ENERGY AND INCREASES EFFICIENCY

By Jay Egg

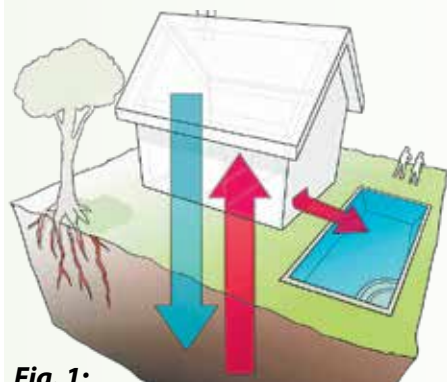


Fig. 1:

Have you stopped to notice all of the heat sources in your home? Things like laptop computers, appliances, lights and people all create heat and are a potential source of energy that can provide domestic hot water and can be used to heat spas and pools. With standard air-source air-conditioners and heat pumps, all of the heat generated inside homes and commercial buildings typically goes up through the return air ductwork and is ultimately exhausted to the outdoors. [See Fig. 1]

You probably already know that geothermal heat pumps (GHPs) are the most efficient heating and cooling systems available. Here's a big benefit of GHPs that you might not have thought about; because GHPs are "water-sourced," they conduct all of the heat that is being pulled from your home inside a one-inch liquid line. You can choose where you want that heat to be placed. It can go back into the cooler earth, which is typically the way GHP systems are designed, or with a little modification, that heat can be transferred directly into a pool or spa. Brilliant! [See Fig. 2]

Take a look at the illustration and you can easily see how amazing the benefits of re-using heat energy can be for you. For any readers who are not quite up to speed on geothermal technologies here's a little refresher:

Outdoor temperatures fluctuate with the changing seasons but underground temperatures don't change as dramatically, thanks to the mass and insulating properties of the earth. Remember that the crust of the Earth is a big solar collector, and stores solar-thermal energy. Four to six feet below ground, temperatures remain relatively constant year-round. A geothermal system, which typically consists of an indoor handling unit and a buried system of pipes, called an earth loop, or a pump

to reinjection well, capitalizes on these constant temperatures to provide "free" energy. As a matter of fact, governments worldwide are making the switch to GHPs in order to eliminate the CO₂ emissions that come from combustion heating. Geothermal replaces combustion heating and related emissions with renewable solar energy, pumped from the Earth.

With some minor modifications, the waste heat from appliances and devices in the home can be channeled into usable heat for domestic hot water (DHW), swimming pools, and spas. [See Fig. 3]

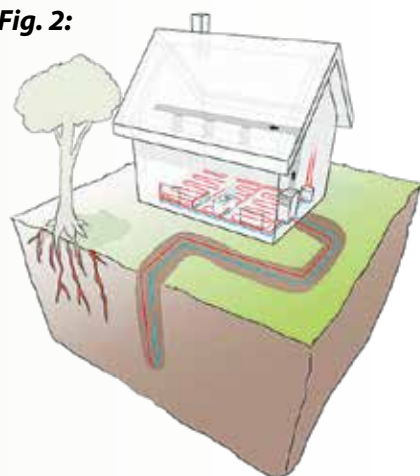
Let's look at the different ways that a pool is normally heated; fossil fuel (combustion heating), electric resistance, solar, or a heat pump (either "air-sourced" or "geothermal-sourced").

Fossil fuel or combustion heating of potable water, pools and spas is an old favorite. First cost is relatively low, but that comes at a higher price environmentally and monetarily as you move forward (due to high CO₂ emissions).

The most energy-efficient and renewable source for potable water and pool heating is solar-thermal, but direct solar-thermal heating is dependent upon the cooperation of the weather. Cloudy and cool days can mean a cold pool, and may require need for backup heating sources much of the year.

Electric resistance heating uses straight electricity through electrodes or heating elements over which the water passes, providing a clean and safe water heating alternative, but electric resistance can use lots of electricity. Using the Coefficient

Fig. 2:



Engineered drawing of a house with Hydronic pipes.

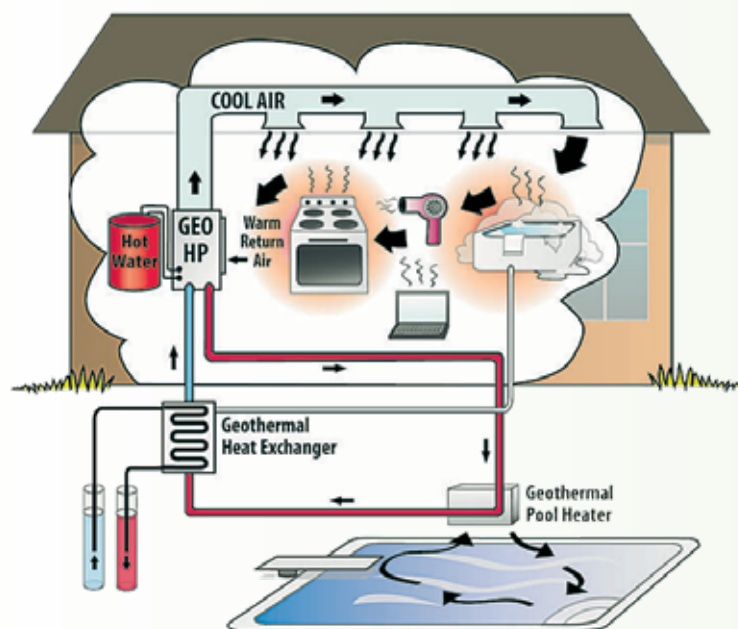


Fig. 3: Load Sharing. All image credits: EggGeothermal, All artwork by Sarah Cheney

of Performance (COP) rating system for heating equipment, traditional resistance electric heating has a COP of 1.0, meaning that one unit of heat is provided for each unit of electricity, a one-to-one ratio, or 100% efficient in the COP rating system. This is a little bit heavy on calculations; for those that like this kind of thing take a look at bit.ly/egg-geo-pool-heating. It also gives a primer on Energy Efficiency Ratings for cooling.

Air-source heat pumps (AHP) designed for pool and potable water heating, and use outside air, pumping heat out of the ambient air into your pool or hot water tank. However, they too rely somewhat on cooperative weather conditions, that is; air temperatures being warm enough to facilitate efficient extraction of heat to transfer to potable water and/or pool heating needs. AHP efficiencies are in the 3.0 COP ranges (300% efficient) when the outdoor air temperature is above freezing. If the temperature is much below freezing, AHPs don't function.

For swimming pool and spa heating, the best scenario is attained with a geothermal heat pump, pulling heat from a dependable, steady and renewable energy source; the solar energy stored in the earth. Geothermal heat pumps (GHPs) can have a 5.0 COP (500% efficient) or more.

While you're paying for electricity to run your cooling system, you are also providing for the energy to run computers, lighting, blow dryers, ovens, and domestic water heating. Your home's cooling system

must use electrical power to remove the heat created by all of these internal gains on top of the occupant loads. You end up paying for energy twice to remove this waste heat through the process of cooling your house. Going back to the first thought in this article, why not channel that heat somewhere else where it's needed, like your pool, spa or DHW tank?

There are tens of thousands of geothermal heated pools around in the US. There is a good chance that the local YMCA, hotel, health club or community pool near you already has geothermal-sourced pool heating. Surprisingly, many of these still have air sourced cooling systems that could be converted to geothermal (and likely will be) during the normal course of HVAC equipment attrition and upgrade (another opportunity for income for plumbing and heating contractors!).

Why not share with your friends and neighbors how they can stop paying two and three times to move energy, and share the loads in their homes and businesses; show them how you can help them to enjoy the savings of thermal load-sharing with a geothermal HVAC system.

Does this make sense to you? Leave a comment and let me know what you think...

Jay Egg is a geothermal consultant, writer, and the owner of EggGeothermal. He has co-authored two textbooks on geothermal HVAC systems published by McGraw-Hill Professional. He can be reached at jayegg.geo@gmail.com.

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Solar Has RECs. Now Biomass and Heat Pumps Do, too!

By Jim Van Valkenburgh

Until recently, a biomass boiler produced only heat while a solar PV array generated both electricity and Renewable Energy Credits, or RECs. With the advent of thermal RECs in New Hampshire, Massachusetts, and Connecticut, biomass looks even more attractive!

Renewable Energy Credits were created years ago, mainly as a way for power companies to comply with state government regulators who require utilities to provide a certain percentage of the electric power they sell from renewable sources. Should a utility not be able to meet this by itself, they must purchase RECs to meet the requirement.

New Hampshire requires power companies to generate 23.8% of the power they provide from renewable sources. Because most are not able to do this, they are forced to purchase thousands of RECs each year. They will pay between \$10 and \$29 for each REC they buy, depending on current market prices. Therefore, new biomass boiler sites which will burn many tons of wood pellets or chips can generate thousands of dollars' worth of RECs each year. The financial benefit to a biomass boiler owner is significant.



Mascoma Valley Regional High School's new front entrance and their wood pellet boilers. MVRHS photo: Eckman Construction. Pellet photo: Froling Energy.

The formula goes like this: 1 REC = 3.412 million BTUs (or 1 megawatt hour) generated from an approved source such as a wood pellet- or chip-fired boiler that operates within some fairly tight emissions standards. Those standards are an important part of the regulations.

For example, a school that is offsetting the burning of 40,000 gallons of fuel oil by burning 330 tons of wood pellets would generate about 1300 RECs each year. If RECs are sold for a net cost of \$16 each, they would generate \$20,800 of new income for the school. Bulk wood pellets

typically sell for \$235 a ton, so selling the RECs would reduce the annual pellet fuel cost by 27%, down to about \$167 a ton.

If this same school burned PDCs (precision dry wood chips) instead of wood pellets, they would burn 427 tons which also generates about 1300 RECs each year. Similarly, if the RECs sold for \$16 each, they would generate \$20,800 of new income for the school. Where PDCs are usually sold for \$120 a ton, RECs reduce their cost by 59%.



At a time of cheap fuel oil prices, thermal RECs are keeping biomass quite attractive. Thermal RECs drop the net cost of precision dry wood chips to the equivalent of 76 cents a gallon of oil while wood pellets drop to \$1.45 a gallon. Pretty incredible!

New REC regulations in 2012 authorized thermal RECs in New Hampshire requiring that a percentage of a utility's renewable energy portfolio come from thermal sources—including biomass boilers, solar thermal systems, and geothermal heat pumps. This is assured through December 31, 2025.

A bill passed in 2014 in Massachusetts (Mass S.2214) enables the generation and sale of AECs, Alternative Energy Credits (basically RECs) from these same thermal sources. Connecticut has also passed a similar law. Unfortunately, no such bill has passed in Vermont or Maine.

To measure RECs, special metering devices must be installed on the boiler system with their accuracy verified by an engineer. In order to sell RECs, further regulations must be followed, but for bigger biomass fuel users, these costs are dwarfed by the net income produced from thermal RECs.

If your building is burning large quantities of fuel oil each year, then now is the time to consider biomass!

Jim Van Valkenburgh is VP of Business Development at Froling Energy.

An actual thermal REC Example: Pellet boilers in the four public schools of SAU 62 in Canaan, New Hampshire generated over \$18,200 of net profits from thermal RECs in their first year. Each was sold for \$21. The second year was a milder winter with 29% less pellet fuel burned, so less money was generated from thermal RECs. SAU business administrator Deb Ford is very happy with their switch to biomass, which in two successive winters covered 84% and 91% of the space heating needs of their schools.

ROOFTOP SOLAR IN NE?

Cont'd from p. 10

nowhere has the solar industry been more eclipsed than in Florida, where the utilities' powers of obstruction are unrivaled."

"The solar industry in Florida has been boxed out by investor-owned utilities (IOUs) that reap massive profits from natural gas and coal," reports Dickinson. "These IOUs wield outsize political power in the state capital of Tallahassee, and flex it to protect their absolute monopoly on electricity sales."

While Florida might be a laggard on rooftop solar for now, that could all change if some residents are successful in their drive for an amendment to the state constitution to allow for third-party solar ownership (which would allow solar leasing). Of course, the state's utilities have challenged the amendment by creating their own, de-

signed to confuse voters into keeping solar panels off their rooftops.

For more information on where your state stands in terms on rooftop solar, check out Solar Power Rocks 2016 U.S. Solar Power Rankings. Also, visit the website of the Database of State Incentives for Renewables & Efficiency (DSIRE) for a full run-down of state-by-state, federal and other incentives for installing solar panels and other forms of renewable energy equipment.

Contacts: Solar Power Rocks, www.solarpowerrocks.com; Database of State Incentives for Renewables & Efficiency, www.dsireusa.org.

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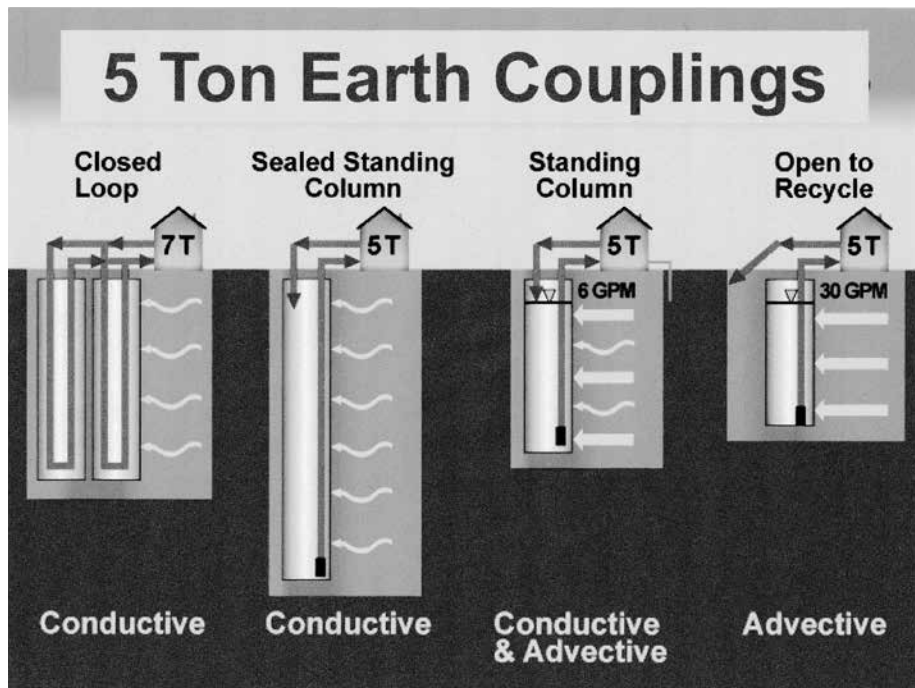
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To Fabricated Reality

Geothermal Ground Loop

By Jim Ashley and George Harvey



A Comparison of four 5-ton geothermal earth couplings. Image© courtesy of Green Mountain Geothermal, LLC.

From the point of view of general economy, there is no more efficient way to heat and cool most buildings than with heat pumps. The most efficient heat pumps are geothermal, which move the heat from or to the Earth's crust, partly because the temperature underground is constant at about 50° F. The efficiency of such systems is heavily dependent on the ground loop, the heat exchanger in the ground.

Nearly all ground loops in the Northeast use water as the heat transfer fluid. The fluid absorbs underground heat, delivers it to the geothermal equipment so the heat can be extracted from it, and then is returned to the earth to get more heat for the next round trip. A few of the systems use refrigerant directly in copper pipes, and are called DX systems.

The most effective ground loops use vertical drilled holes. An example is at Champlain College in Burlington, VT, which started with two high yield wells. Water was drawn from one well to supply its heat to the geothermal equipment in Roger H. Perry Hall, and then it was returned to the aquifer in the other well. This is referred to as an "open loop" system. The heating of the supply water is done by the aquifer.

A second effective type of open ground loop is called a "standing column well" (SCW). In this open loop system the water is returned to the well for rewarming by conductive heat exchange. As the well gets chilled with heavy usage it can be refreshed by bleeding off about 10% of the return water causing new, ground-temperature water to be supplied by the aquifer. The SCW can be the same water well that supplies water to the building, as the quality of the water is not changed. More than 50,000 potential wells that can be used for SCWs have been identified in the Vermont Energy Atlas.

A single SCW can often supply an ordinary home or business with all the heating and cooling it needs. Some wells, however, need to be deepened to provide sufficient additional heat exchange for the size of the geothermal equipment.

In some cases, multiple deep, large diameter SCWs are needed for a project. The 235,000-square-foot Merrimack County Nursing Home, in Boscaawen, New Hampshire has over a dozen. The SCWs supply a total of 326 geothermal heating and cooling units, keeping the temperatures in the nursing home just right!

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- Low static – pumping penalty
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- Poor quality ground water – may cause deposits on heat exchanger or acidity or salt water may shorten life of pump.
- Contaminated ground water – may not return water to the well. UIC rule.
- Sediment – may plug heat exchanger or cause excessive wear.
- Bleed water – no place to recycle or dispose of bleed water.

The CEED grant will provide the following:

- \$4,700 per well toward deepening a standard Standing Column Geothermal Supply Well to provide sufficient depth for a no bleed wetted column. To seal this well bore against incoming water and to allow the sealed no-bleed Standing Column Well to maintain a high static.
- \$1,000 per well for the well driller to develop sealing methods, to document the work performed, and to potentially participate in reporting the work performed.

If you are interested in participating, please contact James Ashley: Green Mountain Geothermal, LLC at 802.684.3491 or jashley@vermontgeo.com

Geothermal designers also use what are termed "deep no-yield wells." These wells are most common in towns like Charlotte, Vermont, where the shale-like rock produces little or no water, and homeowners often resort to drilling multiple wells to find it. When this happens, one of the abandoned wells can then be filled with water and used as an SCW without removing water for other purposes. As they cannot be refreshed, they must be deeper for the same annual heating load than a regular SCW.

A third common type of earth coupling is a "closed loop system." The technology for these has advanced considerably in the last few years. Multiple vertical holes are drilled, and a loop of plastic pipe is put in each hole. The holes are then sealed with special conductive thermal grout. Conductive heat transfer is through the grout and plastic pipe, through which the fluid is pumped. Major disadvantages are the thermal resistance of the plastic pipe, the loop field cannot be refreshed, and larger equipment must be used in comparison to that needed in a similar SCW installation. Large projects, however, can put fields of closed loop wells to effective use, with examples at St. Michael's College in Burlington

and Stowe Resort.

The designers at Green Mountain Geothermal saw that if the rock fractures in a standard SCW could be sealed with cement or a sleeve, the well would be isolated from any aquifer problems. Instead of installing a closed-loop earth coupling, a more efficient, lower cost open loop system that does not require water to be bled off could be installed. With a hope of broadening availability of geothermal options, Green Mountain Geothermal applied for and has received a 2016 Green Mountain Power CEED grant to install and test ten sealed no-bleed SCWs in the former CVPSC service area, which GMP purchased a few years ago. Please see the solicitation ad on this page. Inquiries are appreciated.

Jim Ashley has a degree in hydrogeology and worked for most of his 26 years with the VT Agency of Natural Resources as the well drilling specialist in charge of Vermont's Well Driller Licensing program. In 2003, after retirement, Jim formed Green Mountain Geothermal, LLC, a geothermal consulting business. In July of 2015 Jim also assumed the presidency of the New England Geothermal Professional Association (NEGPA).

Running out of Water

By George Harvey

This spring, NPR aired a story about Lintao, a city in China that had run out of water and residents of luxury high-rise apartment buildings had to fill buckets and lug them up to their apartments, because the taps were always dry. China is hoping to install an aqueduct from southern China to supply Lintao, Beijing, and other cities that also struggle with problems of insufficient water supplies.

China's problem is not unique. A drought in India caused a lengthy shutdown at a 2.6-megawatt power plant because it had no cooling water. A drought that nearly emptied the hydro-electric dams in Tasmania left the island largely dependent on a submarine cable that supplied 40% of its power from mainland Australia, but the cable broke. And California still has a crisis with its drought, the driest in the state's his-

tory, which began five years ago and is just beginning to moderate.

The effects go far beyond a loss of our ability to wash our cars or water our lawns. While industries and agriculture have to reduce use, we also lose such things as our ability to make electric power in conventional power plants. Hydro-electric dams obviously cannot operate at full power with insufficient water, but the same is true of thermal power plants, such as coal, nuclear, and certain natural gas plants. In a severe drought, these plants must reduce their output because they do not have the water they need for cooling. Solar and wind power have a clear advantage here.

The causes of loss of water can be many. The first thing that comes to mind is drought, such as California's. But elsewhere, aquifers must be replenished, and many that are currently in use are being depleted

rapidly for agriculture. The Ogallala Aquifer, which sits below eight states in the Midwest, is being severely strained.

Loss of water, however, is only one problem that can threaten an aquifer. Another is intrusions of salt water, which happens commonly along the coasts, threatening many coastal cities' water supplies.

Yet another problem is pollution, which can come from a variety of sources. Not only can agricultural waste and chemical spills foul surface water, it can pollute ground water and wells. Anything that gets onto the ground can get into the ground, where it will stay until it resurfaces.

Fracking is particularly insidious, because chemicals are being intentionally put underground. Ordinary citizens do not have access to information about what they are, and are prevented from having knowledge about how to protect themselves from them. Scientific knowledge of conditions far underground is often very poor, and it is becoming evident that aquifers may be permanently poisoned for the sake of short-

term profits from natural gas.

People commonly think that current water problems are limited to California and other western states, but cities with increasingly limited ability to supply water include Miami, Atlanta, Cleveland, Lincoln, Nebraska, and Washington, DC. In the Northeast, lakes are being poisoned with waste, which supports toxic blooms of algae, leaving communities near them without the resources they would provide.

In a time when climate change reduces our ability to rely on rain, we are poisoning wells along with the surface water. We need to find a better way.

Start at home and be more aware of your own usage and waste. Please use green eco-friendly products to wash your vehicles, dishes, yourself, your dog, and keep those chemicals off your lawn and garden. Water is nature's most prized possession. This precious commodity is being wasted and polluted more each day. It is a big problem. We need clean water! It is often not given the high priority, but it is absolutely vital.

Massive Victory for Seven Kids in Climate Change Lawsuit in Washington State



Five of the seven youth petitioners with their attorney, Andrea Rodgers, after the hearing. Photo courtesy of Our Children's Trust.

Today, in a surprise ruling from the bench in the critical climate case brought by youths against the State of Washington's Department of Ecology, King County Superior Court Judge Hollis Hill ordered the Department of Ecology to promulgate an emissions reduction rule by the end of 2016 and make recommendations to the state legislature on science-based greenhouse gas reductions in the 2017 legislative session.

Judge Hill also ordered the Department of Ecology to consult with the youth petitioners in advance of that recommendation. The youths were forced back to court after the Department of Ecology unexpectedly withdrew the very rulemaking efforts to reduce carbon emissions the agency told the judge it had underway. This case is one of several similar state, federal and international cases, all supported by Our Children's Trust, seeking the legal right to a healthy atmosphere and stable climate.

"For the first time, a U.S. court not only recognized the extraordinary harms young people are facing due to climate change, but ordered an agency to do something about it," Andrea Rodgers, the Western Environmental Law Center attorney representing the seven youths, said. "Ecology is now court-ordered to issue a rule that fulfills its constitutional and public trust duty to ensure Washington does its part to reduce greenhouse gas

emissions and protect the planet."

In granting the youth a remedy, Judge Hill noted the extraordinary circumstances of the climate crisis, saying, "This is an urgent situation ... these kids can't wait." The court discussed the catastrophic impacts of climate destabilization globally, including the impending loss of polar bears and low-lying countries like Bangladesh. The court explained that while it had no jurisdiction outside of Washington State, it did have jurisdiction over the Department of Ecology and would order the agency to comply with the law and do its part to address the crisis.

"It was absurd for Ecology to withdraw its proposed rule to reduce carbon emissions," petitioner Aji Piper, who is also a plaintiff on the federal constitutional climate lawsuit, supported by Our Children's Trust, said. "Especially after Judge Hill declared last fall that our 'very survival depends upon the will of [our] elders to act now ... to stem the tide of global warming.' I think Ecology should be ashamed by its reversal of potentially powerful action and today, Judge Hill issued a significant ruling that should go down in history books. Our government must act to protect our climate for benefit of us and future generations."

Reprinted with permission from EcoWatch. Read more at ecowatch.com.

Source: <http://bit.ly/7-Kids-win>

NY's 1st Community-Shared Solar

Cont'd from p.21

High Peaks Solar

High Peaks Solar is starting community projects of one to two megawatts (MW) for customers in NYISO Zones F (Capital Area) and E (Mohawk). The sites with greatest customer interest are being prioritized. The first projects are expected to come on line in the middle of next year.

Contracts will vary to match the needs of customers. One option will be for 0% down with payments on a pay-as-you-go basis. With higher down payments, the price per kilowatt-hour (kWh) of electricity will be lower. Also, the length of the contract term is variable. Accounts can cover amounts of electricity up to 110% of average usage, with a cap of 25 kilowatts.

People who change residence can take the account with them if they stay in the

same zone and are serviced by the same utility. Otherwise, the account can be transferred to a new owner. There may be an option to renew the contract open for those who stay to the end of their contracts.

High Peaks intends to design, build, and maintain the solar array, without passing ownership over to someone else, maintaining long-term relationships with their customers. Their website is highpeakssolar.com, and the phone number is 518-209-6727.

Also of note in New York

NYSERDA, Pratt Industries, and EnterSolar completed the second largest state-supported solar project in New York City. The 1.4-MW project is on the roof of a Pratt Industries plant on Staten Island.

G.E.T RECOMMENDED READING

1. NEW for 2016! *Reinventing Green Building*, by Jerry Yudelson. New Society Publishers, 2016. See the book review on page 26. This is a must-read for everyone interested in green building. Reinventing Green Building is an insider's unique critique of why certified green buildings are failing to provide large-scale carbon reduction. It is a potent vision for the future that the green building industry needs NOW. Its web site is reinventinggreenbuilding.com

2. *Green Light at the End of the Tunnel, Learning the Art of Living Well without Causing Harm to Our Planet and Ourselves*, By Anna Edey. Trailblazer Press, 2014. We all know that the way we are living is not sustainable. This book shows us the tools that are available to achieve sustainability and save the world, while we move on to a more comfortable and richer way of living in the process. It can be ordered online at solivagreenlight.com.

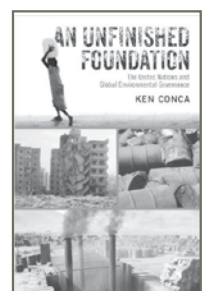
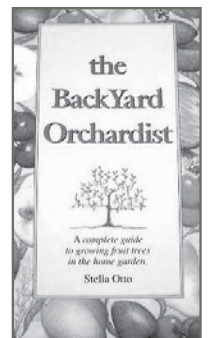
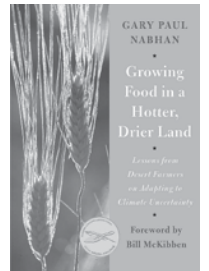
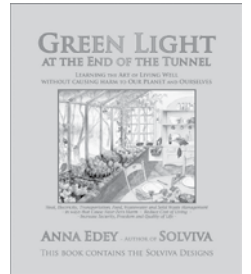
3. *Growing Food in a Hotter Drier Climate, Lessons from Desert Farmers on Adapting to Climate Uncertainty*, by Gary Paul Nathan. Chelsea Green, 2013. This book deals with the uncertainties that are increasingly becoming normal for those who garden or farm to grow food. The author is one of the world's leading experts on growing food in dry climates. Bill McKibben wrote the foreword. The book's web page can be visited at bit.ly/growing-food-in-hotter-land

4. *The Better World Shopping Guide, Every Dollar Makes A Difference*, by Ellis Jones. Fifth edition. New Society Publishers, 2015. This book is advertised as, "The only comprehensive guide for socially and environmentally responsible consumers available, this book ranks every product on the shelf from A to F so you can quickly tell the 'good guys' from the 'bad guys' - turning your grocery list into a powerful tool to change the world." The fact that it has gone into a fifth edition speaks to its usefulness. The book's web page is betterworldshopper.com/book.html.

5. *The Backyard Orchardist, a complete guide to growing fruit trees in the home garden*, by Stella Otto. Trade distribution by Chelsea Green Publishing Company, 2016. This is an expanded and updated edition. Its intended readers are new fruit gardeners all over the country, and anyone who is into gardening, homesteading, and permaculture. Stella Otto's website has several pages devoted to it. We suggest you start at stellaotto.com.

6. *The Life Cycles of the Council on Environmental Quality and the Environmental Protection Agency, 1970 - 2035*, by James K. Conand and Peter J. Balint. Oxford University Press, 2016. This book starts with an examination of the CEQ and EPA, starting in 1970. It then examines the possible trajectories on which these organizations could develop. The web page for the book can be visited by going to bit.ly/EPA-CEQ-lifecycles.

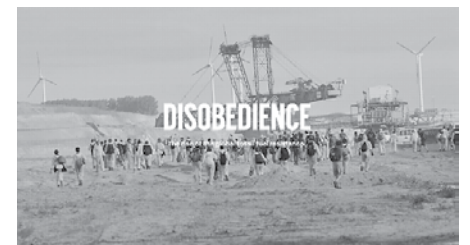
7. *An Unfinished Foundation, the United Nations and Global Environmental Governance*, by Ken Conca. Oxford University Press, 2015. An Unfinished Foundation contains detailed case histories of how the environment has been treated in each of the UN's four mandate areas (international law, peace and security, human rights, and human development). It offers a provocative critique of the UN's historical approach to global environmental governance and argues for the importance of rights-based, peace-enhancing, and conflict-sensitive policies in the UN's environmental work. Its web page can be visited at bit.ly/unfinished-foundation.



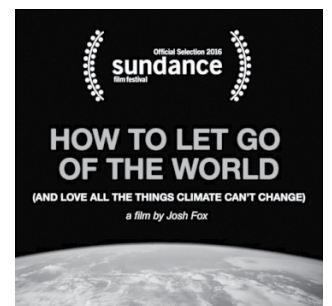
G.E.T RECOMMENDED DOCUMENTARIES

1. *Disobedience*, by 350.org. This is a powerful video about the power of people who oppose climate change, environmental damage, and corporate and political corruption. The people who speak in it come from all parts of the world and are of all levels of society. Their words punctuate and clarify the video images, providing a provocative overall picture of the state of the world and what to do about it. Published on May 20, 2016.

32 minutes. 'Disobedience' is a must-see documentary. It is available on line, and its short length makes it especially easy to view. This documentary is available at: bit.ly/disobedience-video.



2. *How To Let Go Of the World And Love All The Things Climate Can't Change*, by Josh Fox. In this video, Oscar-nominated director Josh Fox (Gasland) continues in his deeply personal style, investigating climate change - the greatest threat our world has ever known. Traveling to twelve countries on six continents, the film acknowledges that it may be too late to stop some of the worst consequences and asks, what is it that climate change can't destroy? What is so deep within us that no calamity can take it away? An HBO Documentary film. 127 minutes. Website: HOWTOLETGOMOVIE.COM.



Energy Labels for Homes Now Available in Vermont

Information on a home's energy performance can be of great value to homeowners, buyers, and sellers. Yet, this information is often hidden – integrated into a range of elements in a home, including mechanical systems and the building shell itself – making energy performance virtually invisible until now.

Vermonters now have an energy label for homes. The Vermont Home Energy Profile reveals a home's expected energy use and costs and provides an overall Home Energy Score, based on U.S. Department of Energy (DOE) standards. Available for single-family homes and townhouse-type condominiums in Vermont, the profile shows homeowners how their home's energy performance compares with that of other homes. The profile enables sellers to communicate the energy performance of their home to potential buyers. It can be used by home buyers as an "energy inspection," providing information about what to expect in terms of energy performance and costs. The profile also creates

an opportunity for buyers to include efficiency improvement costs in mortgage financing at the time of purchase.

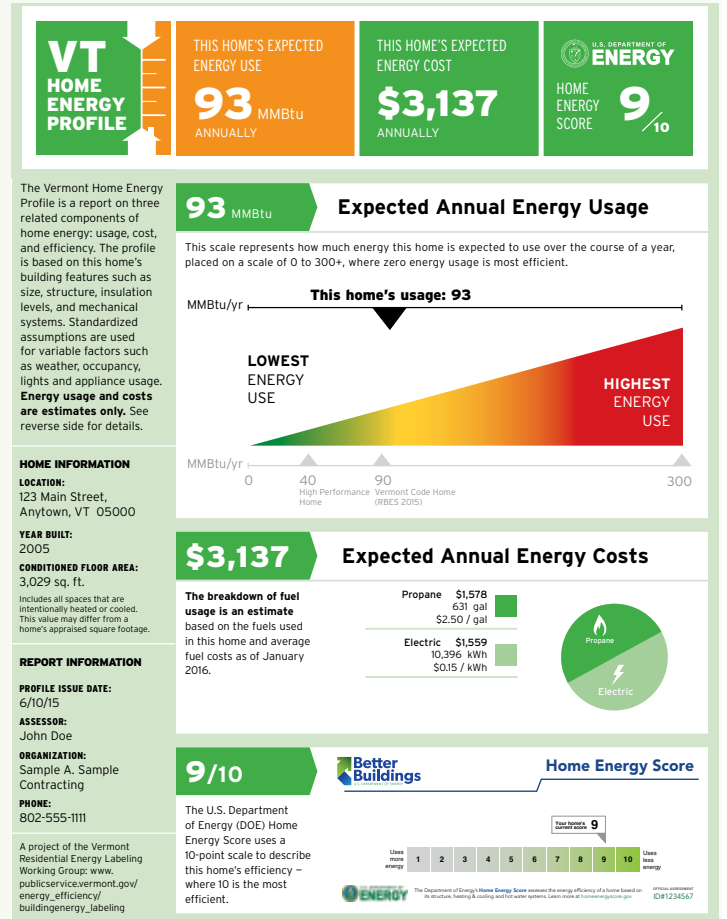
The Vermont Home Energy Profile is an independent, objective assessment based on a home's features such as size, structure, insulation levels, and mechanical systems. The profile's energy use and cost estimates include electricity, gas, oil, and wood, using standardized assumptions about weather, occupancy, and usage of lighting and appliances. It does not rely on actual utility bills.

How to Get a Profile


The Vermont Home Energy Profile is available through Vermont contractors, home inspectors, and energy auditors who have been certified as DOE Qualified Assessors. Assessors set their own prices, currently estimated to be in the \$100-300 range. When a Home Performance with ENERGY STAR contractor provides a profile in conjunction with an energy audit or improvement project, the profile cost may be lower.

Once the visit is scheduled, the energy assessor will come to your home and conduct a one- to two-hour walkthrough and an inspection of elements of your home, including insulation levels and heating equipment. With this information, the assessor will produce a customized Vermont Home Energy Profile, provided to you by email or in hard copy.

You can find a list of Vermont Assessors at http://publicservice.vermont.gov/energy_efficiency/building-energy_labeling or by calling Efficiency Vermont, toll-free, at 888-921-5990.



A snapshot of the Vermont Home Energy Profile. Image from Efficiency Vermont.




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REINVENTING GREEN BUILDING

WHY CERTIFICATION SYSTEMS AREN'T WORKING AND WHAT WE CAN DO ABOUT IT

By Jerry Yudelson, New Society Publishers, June 2016, Paperback 278 pages. \$24.95.

Book Review by N. R. Mallory

Residential and commercial buildings produce 50% of the carbon emissions in the developed world. Jerry Yudelson has a long history and experience with green building as a hands-on LEED practitioner and a leader in the efforts to achieve a sustainable built environment for a decade and a half. He has written 13 professional and trade books on green buildings, integrated designs, green homes, water conservation, building performance and sustainable development.

However, the current systems have not produced the results that need to be developed in order to reduce or eliminate the effect that building inefficiencies are adding to climate change. The author believes that reducing carbon emissions from building operations (and from building products used in making and renovating buildings) should be the primary, overriding task of any green-building rating system.

In Chapter 14, Yudelson discusses solutions beginning with the "Architecture 2030" program that has the clearest result, with all new buildings to be zero net energy/carbon by 2030, less than 15 years from now, and that all existing buildings will use 59% less energy than a 2005 baseline.

The Architecture 2030 program, which was founded by architect Edward Maria, sets the standard for cutting energy use and carbon emissions. The author states that "since the most essential thing in green building is to reduce energy use to considerably lower levels, the key is to work on existing buildings. More than 80% of buildings that will be

consuming energy 15 years from now are already built."

With this in mind, Yudelson discusses goals and real solutions to achieve Zero Net Energy Buildings (ZNEB), retrofits, homes and moving beyond LEED, Green Globes and BREEAM to cut our carbon emissions. Yudelson states that in his view, "future green building rating systems should be at least 50% devoted to directly addressing climate change by radically

cutting energy use, and 100% devoted to a few key performance indicators (KPIs) for green buildings: energy, water and waste, including carbon emissions from building materials (new construction) and purchasing practices (existing buildings) and Scope 3 carbon emissions such as employee commuting and corporate travel."

This all leads to a smart, simple, sustainable system with the key to any green building rating system as "intelligent buildings" that can be managed remotely using cloud-based technologies. The next-gen building rating systems and how the data platforms can help to create new green building rating systems are enlarged upon in detail.

This book is about the problems and ends with real solutions that are involved with the whole building process and how, "by 2020, we can expect this transformation to be evident across the entire design and construction stakeholder community, by opening their understanding to the critical need to expand sustainable strategies for bringing advanced green materials into new buildings."

This is the one book that people in the green building movement needs to read.



Vermont's First Multi-Family Passive House

By Barbara Whitchurch



Artist Rendering of Elm Place. Courtesy of Duncan Wisniewski Architecture.

May 2, 2016 was a chilly, rainy, gloomy day. But as my husband Greg and I entered the lobby of the Fraternal Order of Eagles in Milton, VT, the atmosphere inside was warm and celebratory. This joyful and important event (a groundbreaking ceremony for a groundbreaking project!) marked the launch of the first multi-family Passive House building to be constructed in Vermont -- which was also one of the very first in the United States.

Elm Place will provide 30 affordable one-bedroom apartments for low-income seniors. Developed by Cathedral Square, Elm Place is expected to open in March 2017. Rent will include heat, air conditioning, water, laundry and electricity - all far cheaper than usual. Most notably, Elm Place will be Vermont's first multi-family building built to the Passive House standard. This super energy-efficient building will use roughly 65% less energy than "code" buildings by using high-efficiency windows and doors, more insulation, superior airtightness, and eliminating "thermal bridging" by using state-of-the-art materials and techniques. DC Energy Innovations, Inc. will install a 15kW rooftop solar array. Elm Place will receive an incentive from the Vermont Small Scale Renewable Energy Incentive Program to help offset the cost of this PV system.

State and local officials highlighted the ways in which Elm Place will improve the quality of life for its residents. Kim Fitzgerald, Cathedral Square's CEO, said, "The Passive House focus on sustainability and human

comfort aligns well with our vision for affordable senior housing. It's very exciting to reduce our carbon footprint while increasing comfort and quality of life." And Liz Gamache, Director of Efficiency Vermont, added, "As Elm Place is indeed a project that will provide a viable, healthy and affordable place for seniors to live for years to come. We see the reduction of economic and environmental burdens -- not just for the residents, but their families and also future generations."

So how did Cathedral Square come to adopt the Passive House concept in its plans for Elm Place? For this answer, I approached Chris West, owner of Eco Houses of Vermont. Chris indicated he was involved from an early stage. "I was approached by Michael Wisniewski, the project's lead architect, about being the Passive House Consultant on the job. It was a very exciting moment. Fortunately the owner, Cathedral Square, was very interested in building to the Passive House standard. They didn't need much convincing, just some analysis to ensure the design would hit the standard and be affordable." West explained how Efficiency Vermont and other funding organizations stepped up to ensure that this project would adhere to the Passive House standard. "My part was providing accurate and well-reasoned information by which to make the final decisions. Through it all, Michael Wisniewski and Sam Beall of Duncan Wisniewski Architects were great allies, and Cindy Reid, Miranda Lescaze, and Katie

Forleo of Cathedral Square were behind us the whole time. They all understood that getting this multifamily project done right would set the tone for affordable, comfortable and healthy multifamily projects into the future."

Passive House is an up-and-coming concept in the US. In Europe, however, it is a widely accepted standard of building. Austria now stipulates that all new buildings must adhere to the Passive House standard.

And why not? A Passive House is quiet; the air inside is fresh. It's uniformly warm in winter and cool in summer. It requires a fraction of the electricity needed to power a "code" house, or even a LEEDS house. And, thanks to the increasing availability of sealing and insulating materials, high-performance windows, and knowledgeable lending institutions, a Passive House now costs about the same to finance and build as a conventional home. As a matter of fact, I can't think of a good reason NOT to build to the Passive House standard, be it your new home or office, or your town's hall, school, library, or police department. The future is here. More at www.phausvt.org.

Barbara Whitchurch is a member of the Outreach Committee at Passive House VT.

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ROTTERDAM, NY DEVELOPER BUILDS HOMES TO MEET OUR FUTURE

Net-zero living is now affordable for the general public!

By David Bruns

After a very successful first phase of 72 apartments, completed in September of 2015, netZero Village is completing its second and final phase with 84 more. When completed in September, the \$20 million complex located at 994 Burdeck St, in Rotterdam, New York, will include 156 apartments, a clubhouse with exercise facilities and community room, walking trails, athletic field and community gardens. netZero Village is the first large-scale, market-rate, net-zero apartment complex in the United States. The goal of netZero Village is to prove that net-zero, market-rate multifamily development is commercially viable in the northeast, so the message can be spread to other developers.

The EnergyStar-certified development has proven there is a healthy demand for eco-friendly, net-zero living. The first phase of 72 units was leased in three months. The second phase is also leasing at a brisk pace; after only two months, 50 out of the 84 units are leased. The community includes a mix of one-bedroom and two-bedroom apartments, with and without study areas. The apartments range in size from around 800 square feet up to 1100 square feet. The rents range from \$1,215 to \$1,465 per month, including all utilities, internet, and basic TV.

NetZero Village achieves its net-zero goal through highly engineered buildings that use proven, "off-the-shelf" energy-efficiency technologies combined with harvesting the free power of the sun. This is what makes the "all-inclusive" rent cost possible. Residents never have to worry about increasing energy costs and can count on the same rental payment for the duration of each lease.

It is a goal of netZero Village to offer affordable, net-zero living without sacrificing comfort. The architectural firm involved with this project is Harris A. Sanders Architects from Albany, NY. All of the apartments feature luxury amenities, including a full-sized washer and dryer in each unit, built-in microwave, range, dishwasher, covered parking and electric vehicle charging stations, and more. Energy efficient LED lighting is used exclusively throughout the village.

The single-hung vinyl windows were made by Paradigm. The glazing has a U factor of 0.21 and SHGC of 0.64. Exterior doors are fiberglass made by Therma-Tru. The walls have 3.5 inches of closed-cell spray foam on top of Zip Sheathing (R-23). The roof has four inches of polyisocyanurate foam sheet insulation



The south side of the netZero apartment building. Note the awnings that subtly offset some of the solar gain in the summer months, yet still allow light in to keep lighting needs lower. Photos courtesy of Bruns Realty Group.

It is a goal of netZero Village to offer affordable, net-zero living without sacrificing comfort.

on the deck with 2.5 inches of closed-cell spray foam underneath (R-38). The slab has two inches of expanded polystyrene insulation (R-11). Each apartment has its own Mitsubishi Hyper-Heat mini-split heat pump for heating and cooling. There is single head in each apartment rated at 12,000 BTUs per hour.

Apartments are EPA Indoor Airplus certified, and they are blower-door tested for air leakage of less than 0.6 ACH50. Ventilation is provided by a continuous fresh air exchange from a heat recovery ventilator in each apartment. This, combined with low-VOC materials and hard-surface flooring to minimize dust and allergens, assures superior year-round indoor air quality.

Energy from the sun is harnessed in three ways: (1) by photovoltaic (PV) solar panels that convert sunlight into electricity, (2) by solar thermal panels for domestic hot water, and (3) by the passive solar

design of the buildings, so the sunlight heats apartments during the winter.

There are 66 kilowatts of PV panels installed for each 12-unit apartment building. This is more than enough to meet the 56,000 kilowatt hours needed per building annually. They are mounted on solar carports. The solar hot water systems are mounted on the building roofs. They supply over 80% of the hot water needs.

The passive solar design of the buildings generates roughly 50% of the energy needed to heat the buildings. It includes exterior features for summer shading. The passive solar design and nine-foot ceilings make the apartments feel bright and spacious.

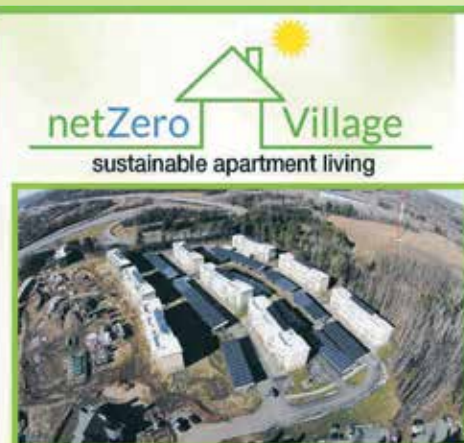
For more information about the netZero Village, visit www.netzerovillage.com.

David Bruns is the general manager of Bruns Realty Group.

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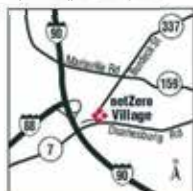
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Energy-Positive Homes Are Transforming the Building Sector

Cont'd from p.1

Vermont or Connecticut. We can then set out to make zero energy the standard for 2030 for the rest of the country.

How does one build fossil-free, energy-positive homes in a cost-effective manner? The first part of the equation is technical. Many in the building industry have proven zero energy is fairly easy to do. Building Science Corporation has suggested some minimum standards for the shell: R-5 windows, R-10 basement slab, R-20 foundation walls, minimum R-40 above grade walls and minimum R-60 attic insulation. You then add a cost-effective hot water system such as the air-source heat pump water heater. The heating and cooling is easily done by air-source heat pumps. Ventilation systems can be as simple as a couple of quiet bathroom fans running continuously at low speeds, a heat recovery ventilator, which provides better energy performance than the bath-fans approach.

To get energy positive homes, one just has to add enough renewables on the roof to power the home and overproduce for other needs, such as vehicles. The key here is the ratio of the roof area to the floor area. A typical two-story, zero-energy home has a roof to floor area ratio of 0.30 to 0.33. To get homes producing enough energy for the transportation sector, one needs to have more roof space relative to the floor area. When the ratio gets into the 0.66 to 0.70 range, then you can solve for the carbon associated with the transportation sector. One can easily do this with a saltbox house with the larger roof area facing south or with

a ranch with the longer dimension facing south. Homes have been built that produce over 10,000 kWh of excess energy in a year. This is enough energy to drive a typical electric car for 30,000 miles, year after year.

The 2015 International Energy Conservation Code (IECC) is currently under public review in Massachusetts. If adopted, this code will bring the Home Energy Rating System (HERS) index to 55 for a standard code-built home. For reference, the IECC 2006 code home was 100.

Over 150 communities in Massachusetts have adopted the stretch code since 2009. This voluntary code requires these communities to go further than the base energy code. The original stretch required energy use to be cut by 30% and carbon emissions 40% compared to buildings built to the base energy code.

Opportunity number 1: We have an opportunity to continue having the stretch code move us towards zero-energy homes. The current proposed residential stretch code simply makes the voluntary 2015 IECC base code's option of scoring equal to or less than 55 mandatory. Homes already using this option would not see any additional requirements. Why not? Let's work toward an additional "stretch" in the stretch code. The Depart-



Rendering of the 85 homes at the Summit Oaks development at Village Hill in Northampton, MA. Photos courtesy of Transformations, Inc.

ment of Energy has a Zero Energy Ready program that is very well thought out. The jumping off point for adding renewables is in the very cost effective range of HERS 50. Let's make the DOE Zero Energy Ready home program the stretch code for new homes.

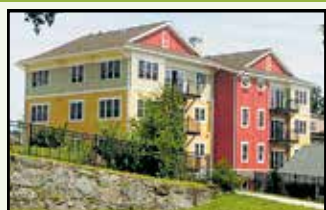
Opportunity number 2: Then what's next? Let's plan a path to requiring all new homes in Massachusetts to get to zero energy by 2025. There is a proposal from Mindy Craig, principal of BluePoint Planning in California. She is the principal writer of the Path to Zero for California. It took about a year of stakeholder meetings and planning for California to create their eight year plan in 2011. The proposal is to do for Massachusetts what has been done in California, spend the time to get the stakeholders on the path together. Massachusetts could be the first cold climate state to require zero net energy for all new homes – an exciting time for changing the way homes are built in the time of climate change.

R. Carter Scott is President of Transformations, Inc., a developer and builder of zero-energy homes and communities and installer of residential and commercial solar systems. Carter is a member of Governor Baker's Zero Net Energy Building (ZNEB) Advisory Council and has been building zero-energy and energy-positive homes since 2008. His email address is carter@transformations-inc.com. The company phone number is 978-772-1390.



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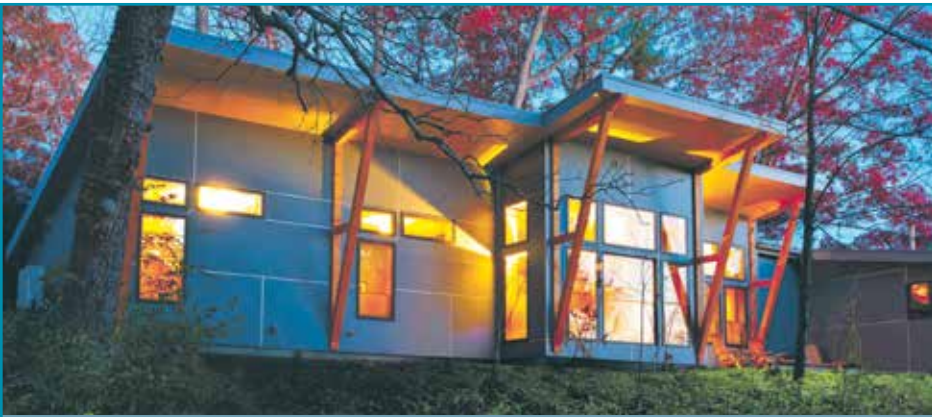
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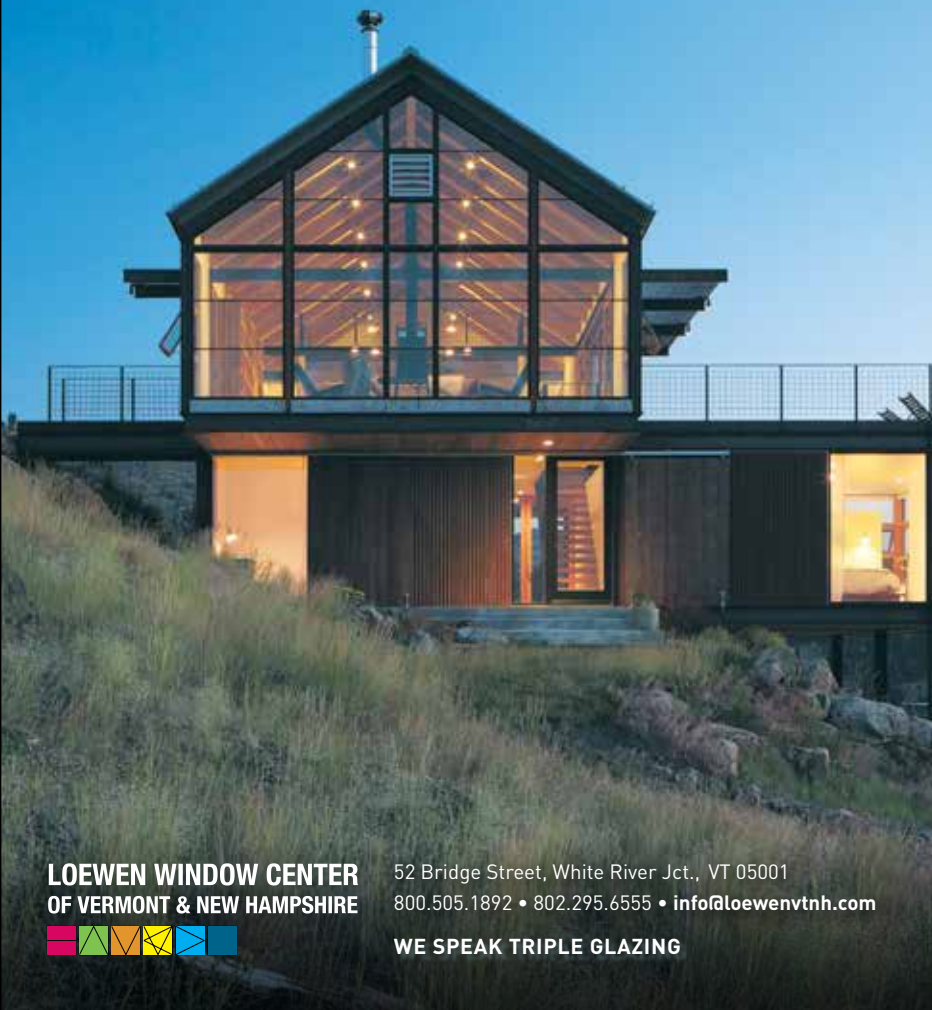
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WE SPEAK TRIPLE GLAZING

High Performance Faculty Housing for Dartmouth

Four faculty houses built by Unity Homes will set a new standard.

By George Harvey

Unity Homes is building four faculty homes at Dartmouth College to an energy standard requiring very high efficiency. Each will house one faculty member's household, but the houses are intended to serve multiple functions. They are designed as places for small groups of students and faculty to meet.

On-site construction was begun in late February and early March. The houses have gone up quickly, and faculty members are expected to move in this summer. The rapid pace is actually rather easy to maintain, because the houses are built from elements that are prefabricated at Unity Homes' manufacturing plant in Walpole, New Hampshire. They can be built to exceptional dimensional accuracy because they are made indoors, in a much more controlled environment than is typical with ordinary construction.

Unity Homes produces the floors, walls, and roofs of its homes in the form of panels and provides the bathrooms as completed modules or "pods." The bathroom pods already include many of their components as they arrive at the site. For example, they have Kohler fixtures already installed, including a wall-mounted low-flush toilet, tub, sink, as well as a vanity. The insulation is installed in all of the wall panels, which also contain service cavities for wiring to be put in place.

The basement areas of the buildings have R-15 or better insulation. Cavities in walls are filled with dense-packed cellulose insulation for R-35. The attic floor has sixteen inches of cellulose, bringing it to R-60. All this is complemented with highly efficient triple-glazed windows from Integrity and Marvin, with a 0.25 U factor.

When the panels are assembled, the high precision manufacture pays off by making tight air-sealing relatively easy for Unity Homes' well-trained crews. This results in homes that typically achieve blower door test results of 0.6 ach50 or less. With that quality of sealing, it is important that they have adequate ventilation, and this is supplied by a Zehnder ComfoAir 550

heat-recovery ventilators with dedicated ventilation ducts. The electric resistance water heater is made by Rheem.

The new faculty homes at Dartmouth are larger than a typical Unity Home, ranging in size from 3,063 to 3,255 square feet. Nevertheless, the heat loads range from 32,600 to 35,100 BTUs per hour. Each house gets a single Mitsubishi ductless mini-split compressor, outdoors, with multiple distribution points indoors.

Wood used for construction is sustainably harvested. The gorgeous beams are Douglass fir from the Pacific Northwest, though other wood is obtained much closer to home. The heavy members are engineered lumber, produced through a process called "glulam," which creates large structural members from smaller, sustainably-harvested trees, without any requirement to cut old-growth trees, in the case of the structural members in these houses.

Some of the carpentry is also unusual. The engineered-wood floors, for example, are "floating"-type floors because not all pieces of flooring are nailed or otherwise fastened, but yet they are very durable. Wood has such an important place in the Unity Homes that it is even used to finish the basement.

Construction with engineered lumber and floating floors implies the use of resins and binders. The standards in use at Unity Homes require that these not off-gas toxic chemicals, such as formaldehyde. What they do have, however, is a high degree of durability, resistance to rot, and even resistance to fire. As hard as it might be to imagine, the engineered beams used by Unity Homes stand up to fires better than

Cont'd on p.31



Webster Street home for Dartmouth faculty nearing completion. Courtesy photos.



Bath Pod being lowered into place with pre-fabricated roof adjacent and ready to install into one of the four hi-performance homes that are being built for Dartmouth faculty and students -- Hanover, N.H.

Faculty Housing *Cont'd from p.30*

steel beams because they char, while steel can simply melt.

Chemical quality is also addressed in the choice of paints. These homes are being finished with Sherwin Williams low-VOC products.

Unity Homes come in different styles, which can be highly customized, to the point that houses of the same style can look very different. The houses built at Dartmouth College are of the Varm style,

named for the Scandinavian farmhouses that inspired them. They are two stories tall with connected garages.

These particular homes are not intended to be fully net-zero in energy use. Nevertheless, they are so energy efficient that they could easily achieve net-zero status by adding on solar photovoltaics, either at the homes or remotely. We can easily imagine that might happen.

Unity Homes website is unityhomes.com. The telephone number is 603-756-3600.



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INTER-LAKES SCHOOL DISTRICT

How Laker Blue Went Green and Became a State Energy Leader

By Seth Wheeler, NHEC

Working with New Hampshire Electric Cooperative (NHEC), Honeywell and other energy professionals, the Inter-Lakes School District (ILSD) is on track to become the greenest, most energy-diverse school district in the state of New Hampshire. The path it took to get there holds lessons for school districts across New England.

ILSD is a cooperative school district serving approximately 1,060 students from pre-school to 12th grade from the towns of Meredith, Centre Harbor, and Sandwich. Like many school districts in the construction boom years of the 1980s and 1990s in New Hampshire, ILSD was less concerned about energy efficiency than it was about making space to accommodate a student population that was growing larger every year.

But as growth slowed and gave way to flat or declining student enrollment, the school district leadership faced the hard reality 10 years ago that its facilities and energy infrastructure were in disrepair, and costing taxpayers thousands in wasted energy costs. In response, the School Board, building administrators and the community came together around a shared vision of a school district that would become a model of energy efficiency with a diverse range of renewable energy. It would also seek to integrate that vision with its classroom curriculum, providing its students with experiential learning opportunities.

From a practical standpoint, the school district divided its energy and facilities



The silo that feeds the new wood pellet boiler at the Inter-Lakes Elementary School will soon become the blank canvas for a student art project. Behind the silo are solar panels that power the school's solar thermal hot water system. Photo: Seth Wheeler

goals into two phases. The first phase would focus on the district buildings – weatherization, lighting upgrades, replacement of inefficient and failing HVAC systems, and building controls. The second phase of improvements has built on the success of Phase I and opened up a range of opportunities that is diversifying the way the district powers its facilities and its students' education.

The goal for Phase I improvements was simply to climb out of the hole that was rapidly filling with wasted energy and money. To that end, most of Phase I work was focused on upgrading or replacing heating and ventilation equipment, as well as building-envelope improvements. In a precursor to Phase II improvements, Phase I also included ILSD's first venture into renewable energy: a 16 MMBTU-per-year solar thermal hot water system that supplemented an existing oil-fired

domestic hot water system. ILSD also performed lighting efficiency upgrades on more than 1,000 lights and installed occupancy sensors in key areas. All told, Phase I was a \$2.3 million project that will be entirely paid for over 15 years by grants and the energy savings generated by the efficiency improvements. It reduced oil consumption by 50% (48,000 gallons/yr.), electric consumption by 38% (700,546 kWh/yr.), and set the stage for the Phase II improvements that will reduce oil consumption to near zero by 2017.

Phase II projects are even more ambitious and include:

Inter-Lakes High School

- Replacement of 638 interior lights with LED lamps; install occupancy sensors
- Installation of new 1.7 MMBTU/hr output wood pellet-fired boiler system
- Installation of new 132 kW (AC) grid-tied photovoltaic system with system monitoring; installation of energy kiosk at high school to display real time produc-

tion data and carbon offsets

- Replacement of rooftop energy recovery unit system
- Installation of economizer, door heaters and electronically commutated motors in cafeteria coolers
- Installation of heat pumps in library.

Inter-Lakes Elementary School

- Replacement of 847 interior and exterior lights with LED lamps
- Installation of new 1.7 MMBTU/hr output wood pellet-fired boiler system
- Installation of new 156 kW (AC) grid-tied photovoltaic system with system monitoring; installation of energy kiosk at elementary school to display real time production data and carbon offsets
- Installation of 73 MMBTU/yr solar thermal hot water system
- Removal and replacement of all existing windows and exterior doors
- Installation of economizer, door heaters and electronically commutated motors in cafeteria coolers.

Sandwich Central School

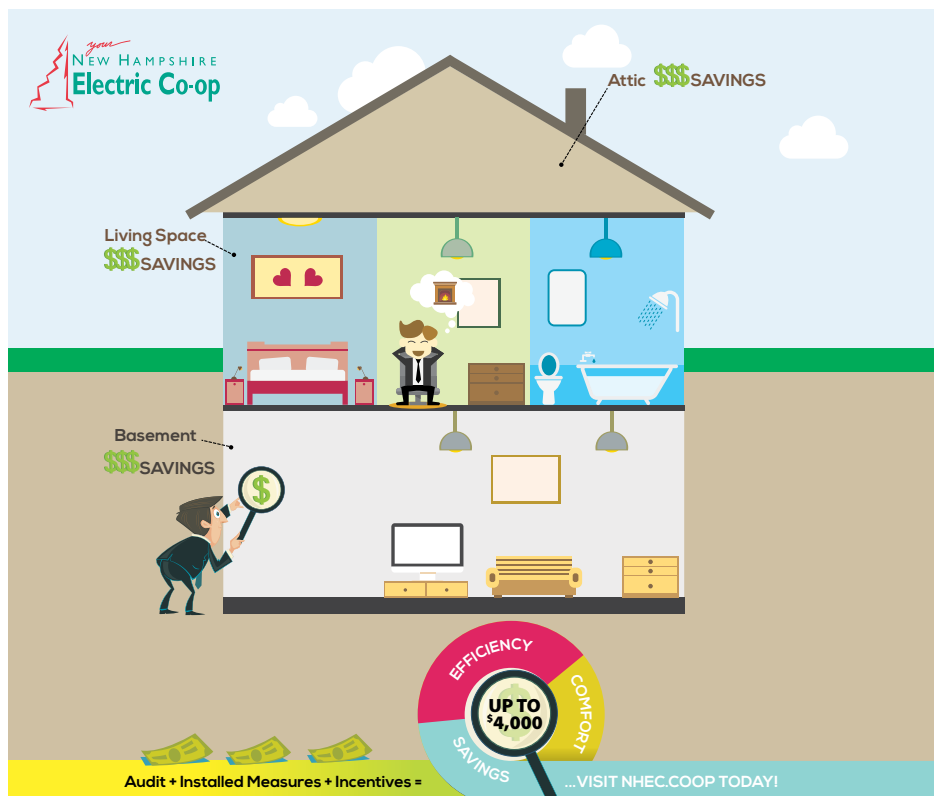
- Installation of new 100 kW (AC) grid-tied photovoltaic system; installation of energy kiosk at school to display real time production data and carbon offsets.

All told, the school district will have cut its energy costs by more than \$170,000 per year when Phase II projects are completed.

NHEC is proud to have played a role in the success of the Inter-Lakes School District's energy goals. During the development of Phase II projects, NHEC Energy Solutions program administrators identified refrigeration and lighting upgrades that enabled the district to receive \$55,500 in NHEC incentives from its Municipal Energy Efficiency Program towards



Cont'd on p. 35



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THE IEE AT VERMONT LAW SCHOOL DRIVING ENERGY TRANSITION

By Benjamin Jervey



The first ever VLS Energy Clinic Team at the Eaton House working on improved legal and business models for community-owned solar. Courtesy photos from the Institute for Energy and the Environment.

Our world's energy challenges, as any loyal G.E.T. reader already knows, are intimately intertwined with our great environmental, economic, health, and social challenges.

Unfortunately, despite the fact that energy is one of the world's largest industries and is inextricable from the world's other largest industries, our society as a whole is woefully energy-illiterate. Few people — even many committed climate and clean energy advocates — stop to think (or to really understand) what's happening behind that light switch or ignition.

The Institute for Energy and the Environment (IEE) at Vermont Law School is working to help change that. As IEE founder Michael Dworkin has written, "If you care about the environment, energy policy is the single most important influence, and if you care about energy, the environment is the most important constraint."

At this critical moment in history, as low-carbon renewable technologies are contributing ever-increasing amounts to the global energy supply, and as world leaders agreed in Paris to put an end (even if eventual) to the fossil fuel era, it is more important than ever to have well-

educated, deeply-informed energy experts doing the research and analysis, making the policy, advocating for the right systems, building new businesses and helping others transition to a new carbon-constrained reality.

The IEE carries forth a mission to educate graduate students on a wide spectrum of disciplines in the energy field — regulation and law, policy, smart-grid technology, clean transportation and energy markets — and to train students to have truly effective careers during this critical period of energy transition.

To achieve this mission, the IEE works on three coordinated tracks. First, the academic curriculum forms the educational backbone of an energy student's experience at VLS. Second, the Institute's research program produces timely publications in forums and media that inform and influence clean energy policy. Third, the Energy Clinic provides opportunities for our JD, LLM and Masters students to progressively develop the knowledge, skills, and values integral to the practice of energy law and policy, while helping our clients meet local energy needs with reliable, clean and affordable resources.

On the academic front, the IEE offers a Masters of Energy Regulation and Law (MERL) as a one-year degree that provides intensive training at the intersection of energy and law, markets, regulation and policy analysis. Law students can earn an energy certificate, or with a few more courses earn a MERL as a joint degree with their J.D. Current lawyers can refocus their practice in the energy field by earning a one-year LLM in Energy Law. The experience isn't limited to full-time students, and in fact professionals from all over the country head to South Royalton in the summer for a series of intensive one, two- and three-week summer courses that immerse the participants in specific topics, such as: Essentials of the Electric Grid, Global Energy Justice, Renewable Energy Project Finance and Development, and End Use Energy Efficiency.

At the IEE, students can serve as research associates, working on energy policy research projects in a professional setting. The research program is modeled after actual energy consulting firms, and the student researchers tackle real-world research problems for clients. For the past three years, for instance, student research teams have worked for the Fraunhofer Center for Sustainable Energy Systems on a Department of Energy SunShot grant. The Fraunhofer Center is working to commercialize a type of "plug-and-play" solar photovoltaic system that will eventually be marketed at popular retailers as a simple home improvement DIY-type solar solution. The IEE team examined possible regulatory barriers to the deployment of this technology, such as building and electrical codes, and procedural standards.


Finally, the Energy Clinic at Vermont Law School, run at the IEE, was launched in 2014 as the first full academic year energy clinic in the country. According to incoming IEE Director and Professor of Energy Technology and Policy Kevin Jones, "the Energy Clinic allows us to expand upon classroom theory and give students the opportunity to develop the actual legal structures for community solar, as well as implement real projects." One example: student clinicians recently developed model group net-metering and land lease agreements for community solar arrays that are now freely available for communities to use. More recently, a group of student clinicians wrote a comprehensive report on renewable energy credits (RECs) at the request of Vermont State Senate Commit-

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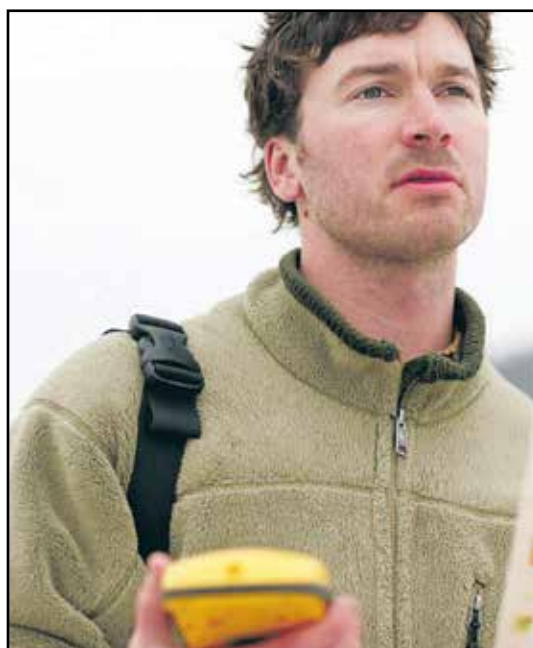
tee on Natural Resources and Energy.

This approach of combining academic learning with professional training has successfully delivered many IEE alumni to important, effective energy jobs, from the Federal Energy Regulatory Commission (FERC) to innovative demand response companies like Enernoc, to regional and national renewable energy development companies, to high power law firms that are working on all aspects of energy development.

Benjamin Jervey is the Climate and Energy Media Fellow at the Institute for Energy and the Environment at Vermont Law School.



The IEE's energy clinicians, research associates, and global energy fellows at Solarfest 2014, Tinnmouth, VT.



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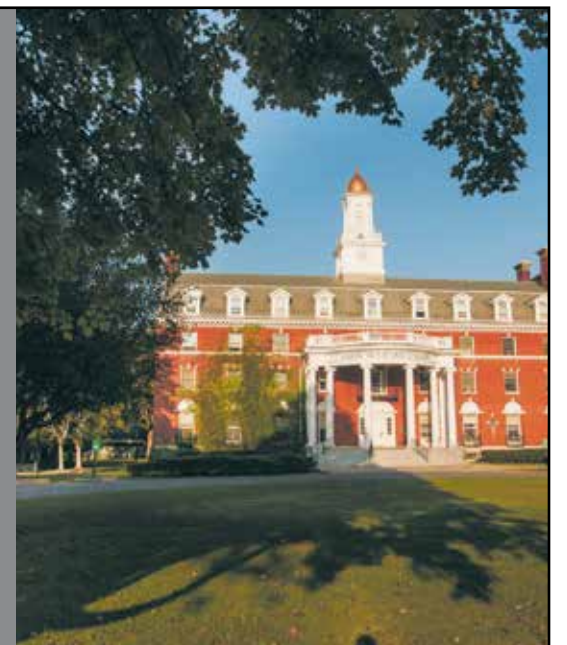
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American Council for an Energy-Efficient Economy: Consumer guide to home energy savings - aceee.org/consumer

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Find Solar: www.findsolar.com

Fossil Fuel Freedom: Group working to make Vermont's energy plan 100% free of fossil fuels:
To join this group go to: groups.google.com/group/fossil-fuel-freedom

Greywater Info: www.oasisdesign.net/greywater

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

Home Power Magazine: www.homepower.com

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

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

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

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

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

National Solar Institute: www.nationalsolarinstitute.com

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

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

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

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

NH Office of Energy and Planning: www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org

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

SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

Solar Living Source Book: realgoods.com/solar-living-sourcebook

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

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

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

The Energy Grid: www.pvwatts.org

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

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

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

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

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

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

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

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

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Ingredient of the Month

By Larry Plesent

DREAMING...

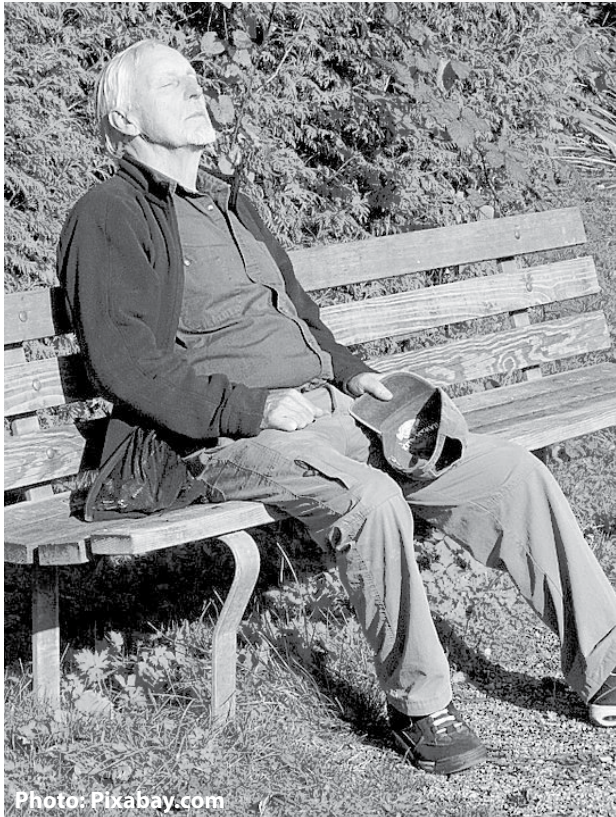


Photo: Pixabay.com

I dreamed I was the last of my generation. Old beyond years, I sunned myself on a bench and watched the children play.

"Great grandpa! Great grandpa! Tell us about the old days. What took out all the people?"

"Well, children. Many people back then were concerned about the radiation. We made electricity from radioactive elements back then. Sometimes it would leak out and poison huge swaths of the planet. But that is not what did it.

"Then there were all the chemicals in the food supply such as herbicides, insecticides, growth hormones, antibiotics, artificial fertilizers... You are lucky that we stopped doing that before you were born. A lot of people worried about them, but that is not what killed us off."

"What was it? What was it then?"

"We started messing around with genetic modification. We created life forms without ecological controls. But that is not what did it.

"We also had a lot of trouble with metals. Metals are found in nature, but rarely in pure form. We used electricity to purify the metals. Then they leached into the food and water (through pipes) and affected people's brains."

"Is that what did it?"

"That was bad but metals didn't do it."

"You have to remember that we made plastics from petroleum back then. The plastic got into everything — the food, the water, the ocean... It made a lot of people sick."

"So it was the plastics that did it?"

"Not really. We also burned coal and oil for energy. And we rubbed petroleum jelly onto our skin. Nasty stuff! But it wasn't the petrochemicals that killed off all the people."

"What was it? What was it?"

"It was the adhesives. Took years to figure it out. But in the end, it was the glues and adhesives that took us out. I was allergic to most of those things and avoided them. Now I am the last of my times. That is my blessing and my curse. It was the damn adhesives that did it."

And then I awoke ... and put the duct tape in the garage.

This is the Soapman wishing you a happy summer and a better, more natural tomorrow for us all.

How Laker Blue Went Green

Cont'd from p.32



efficiency investments that will provide savings of \$23,548 per year. Further, NHEC provided project financing of \$35,327 through its Smart START Program for lighting and refrigeration measures installed during 2014. The Smart START Program allows NHEC members to install energy efficiency measures with no up-front investment and pay for them over time on their electric bill using the savings from the installed measures. Finally, NHEC is purchasing the thermal RECs generated by the wood pellet-fired boilers installed at both the high school and elementary school.

ILSD has also partnered with Honeywell, which has helped the district chart its ambitious, 10-year effort to remake its energy infrastructure. According to Honeywell consultants, ILSD will be the "greenest" school district in New Hampshire when Phase II work is completed in 2017. By then, Honeywell estimates that ILSD will have reduced its overall energy costs by 40%; provided 46% of its baseline energy needs by renewable energy sources; replaced 71% of its baseline oil usage by renewable energy sources; replaced 35% of its baseline electricity use by renewable energy sources; and self-funded over \$4.7 million in capital improvements without increasing the current budget.

Climate Change Equals Zika Virus

The history of the Zika virus and environmental management

By Roddy Scheer and Doug Moss

Zika virus, first discovered in Uganda's Zika Forest in 1947, is transmitted to humans and other mammals through the bite of an infected Aedes species mosquito, and typically causes only a mild and short-term illness (fever, rash, joint pain, conjunctivitis) that likely immunizes the victim from future infections. But a Zika virus infection during pregnancy can cause a serious birth defect called microcephaly, where the fetal head doesn't develop to the proper size, leading to other severe fetal brain defects.

Over the last half century, occasional Zika outbreaks have been reported in tropical Africa, Southeast Asia and the Pacific Islands. But the first confirmed case in the western hemisphere last year in Brazil now has public health experts concerned about its potential to develop into a global pandemic. "Because the Aedes species mosquitoes that spread Zika virus are found throughout the world," reports the U.S. Centers for Disease Control and Prevention (CDC), "it is likely that outbreaks will spread to new countries."

Indeed Zika's recent spread far beyond a few isolated pockets of the tropics may be partly attributable to how we have taken care of the environment in the modern industrial era post-World War II. Durland Fish, a professor of microbial diseases, forestry and environmental studies at Yale University, is not surprised

Zika has spread widely, given the proclivity of the Aedes mosquito (which is also responsible for spreading dengue fever and chikungunya virus) for inhabiting artificially human-made habitats like tires, cans, plastic containers and rain barrels.

"It doesn't live in the ground, or in swamps, or any other kinds of places where you would normally find mosquitoes," reports Fish in a recent Washington Post article. "So humans have created an environment for it to proliferate, by having all of these water-containing containers around, and the mosquito has adapted so well...it's really kind of a human parasite. It's like the cockroach of the mosquito world."

And the mismanagement of urban waste is far from the only environmental factor in the spread of Zika. Environmentalists point out that dam-building and deforestation are also significant contributors to increased amounts of standing water where Aedes mosquitos can breed and come into contact with growing human populations. Restoring natural hydrological flows and leaving forests intact would be good defense mechanisms against the spread of mosquito-borne diseases of all kinds.

But whether we can contain the warming of the planet as a result of human greenhouse gas emissions might be the single biggest factor in whether we can



The Aedes aegypti mosquito can infect humans with the Zika virus when it takes a blood meal. Credit: Sanofi Pasteur, FlickrCC.

prevent Zika from morphing into a global public health menace. The World Health Organization (WHO) recently reported that predicted global average temperature increases of two to three degrees Centigrade would make temperate latitudes hotter, in turn exposing several hundred million more people to Aedes species mosquitoes. Malaria, dengue fever and other mosquito-borne diseases would also surge along with Zika.

"You have to do something about the mosquitoes, and that's strictly an environmental problem, there's no medical

applications to that," concludes Fish. "And focusing on that as an environmental issue is going to have the greatest impact on protecting people."

Contact: CDC Zika Virus, www.cdc.gov/zika/; Washington Post, www.goo.gl/5wnxiS; WHO Zika Facts, www.who.int/mediacentre/factsheets/zika/.

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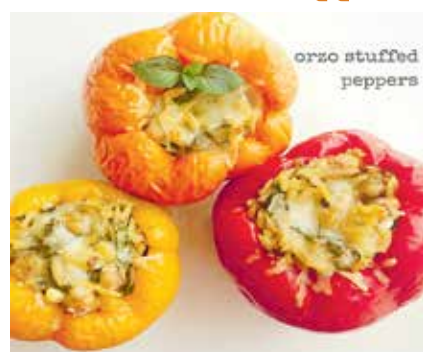
**HARVESTRIGHT**
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Summer Cooking in the Solar Oven*

We're approaching the longest day of the year in New England, with a whopping 15-plus hours of sun per day for the next month or so. Except when clouds and rain drop by there's really no limit to what can be cooked in a solar oven in June, July and August. From pantry basics like steel cut oats for tomorrow's breakfast to show-off Solar Oven Paella, we're cooking it all this time of year, without hesitation.

This month's orzo stuffed peppers takes advantage of low and slow solar cooking, letting the sun roast the peppers to tender sweetness and infusing the unexpected flavor of fresh-chopped mint throughout.

Orzo Stuffed Peppers



INGREDIENTS:

- ½ cup uncooked orzo
- 2-3 large bell peppers
- 1 tablespoon extra-virgin olive oil, plus more for drizzling
- 1 garlic clove, minced
- ½ cup cooked chickpeas, drained & rinsed
- 3-4 kale leaves, stems removed, chopped
- 1/3 cup crumbled feta cheese
- juice and zest of 1 small lemon
- big handful of chopped fresh mint
- pinch of red pepper flakes
- sea salt and freshly ground black pepper
- white cheddar or pepper jack cheese

DIRECTIONS:

Place the Solavore Sport in the sun to preheat. Cook the orzo according to package directions for al dente doneness. Prepare the peppers by cutting out the stems and leaving a two-inch hole in the top. Remove seeds.

Prepare your filling. In a large glass bowl, combine the olive oil, garlic, kale and chickpeas. When your orzo is al dente, drain it and add it (warm) to the bowl and toss. Stir in the feta cheese, lemon juice, lemon zest, mint, red pepper flakes and generous pinches of salt and pepper. Taste and adjust seasonings.

Stuff your peppers with the filling and place in your graniteware pot. Sprinkle the tops with the remaining cheese. Cover your pot and place it in the oven. Cooking time is flexible on this recipe. You want your peppers cooked and the filling heated through. Let it cook, covered, for between 1.5 and 2 hours.

Recipe adapted for solar cooking from the recipe by the same name found on LoveandLemons.com.

*See Solavore Solar Oven ad on this page.

HARVEST RIGHT IN-HOME FREEZE DRYERS

By George Harvey

There are lots of ways to preserve food. In ancient times, meats and fish were smoked, and vegetables and cheese were lacto-fermented. In the Middle Ages, freshly caught ocean fish was packed in salt and sold weeks or months later in Alpine towns. More recently, canning, freezing, and refrigeration came into being. None of these systems is perfect, but all have their uses.

Perhaps the oldest system of preservation is drying, but about seventy years ago, that old technology was updated by being combined with freezing. In freeze drying, foods are taken to about 40° below zero (the point where Celsius and Fahrenheit are the same), and then subjected to an intense vacuum. With this combination of conditions, the ice in the food is removed through sublimation, a type of evaporation in which a solid changes to a gas without going through a liquid stage.

Freeze drying is a very superior food preservation system. This is partly because the food has not been heated in the preservation process. Heat-sensitive nutrition is undamaged, and these include many vitamins and enzymes. Also undamaged are flavors. Without water in the food, and if it is placed in an oxygen-free environment, most foods can be stored for twenty-five years without noticeable loss of quality.

About seven years ago Dan Neville, of Salt Lake City, was considering freeze drying at home and started looking for suitable equipment. He found the least expensive freeze dryer on the market had a steep price tag of \$24,000. Rather than seeing this as a hindrance, however, he saw it as an opportunity. He started work on plans for a freeze dryer for ordinary people.

Three years ago, Neville's company, Harvest Right, began selling freeze dryers for the home at the surprisingly low price of \$3,495, with even lower prices during the sales that occasionally happen. The units can dry seven to ten pounds of food in about 24 hours. The process uses quite a lot of electricity, but we should remember that when food is packed in a Mylar bag with a small oxygen absorber, it can retain fresh flavor and nutrition for many years without any further use of power.

Almost any kind of food can be freeze dried. This includes not just meat, fish, and poultry, but nearly any vegetable, eggs, cheese, and even avocados. Raw foods, cooked foods, and whole packaged dinners can be freeze dried. When I asked Neville what sorts of foods could not be prepared this way, he gave me a single example. "You can't freeze dry peanut butter," he said, "because there isn't any water in it."

I had the really good luck to be able to try a variety of foods that were freeze dried in a Harvest Right machine. Among them were summer squash, tomatoes, strawberries, grapes, apple slices, yogurt drops, and cheesecake. Freeze-dried cheesecake was delicious, and I was amazed. The quality of the foods ranged from extremely good to better than that.



Harvest Right home freeze dryers. Courtesy photo.

This was not merely my own opinion. It was the opinion of Chubbs the Cat. Normally, when he sees me eating something he thinks he would like, he takes a seat next to me and speaks patiently but insistently. When a yogurt drop fell to the floor and he tasted it, he immediately climbed all over me in a mad hunt for more. Others who tasted the freeze-dried food were more polite, but also agreed on quality.

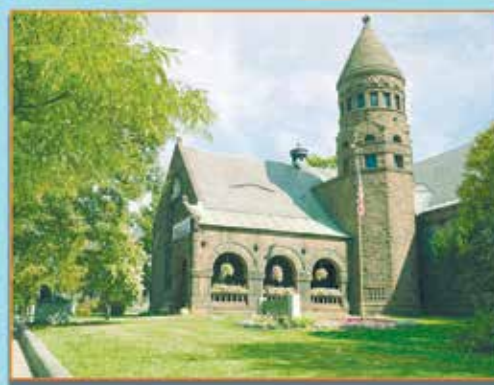
I asked Neville whether living organisms can survive freeze drying, thinking the process might kill pathogens in uncooked food. He responded, "Some customers tell us they have been able to freeze dry cheese cultures or seeds for later use successfully." Now, that is an impressive retention of quality.

The amount of food in a batch and the power needed to process make freeze dryers attractive to groups of people, such as members of a co-operative or church. Certainly, Harvest Right's freeze dryer seems ideal for an individual with a large garden.

Freeze drying certainly beats walking around town looking for cars with open windows in which you can leave excess zucchini. Instead, you can continue to rehydrate and cook the zucchini whenever you want through subsequent years and devote the garden space to other things, which you can also freeze dry. And it can be, and stay, as healthful as you grow it.

Harvest Right's web site is harvestright.com.

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TASTY CRABAPPLES — A PERFECT HOMESTEAD TREE

*With organically-grown tasty crabapples,
you can have your cake and eat it too!*

by David Fried of Elmore Roots



Flowering crab apple tree on Montpelier Street by D. Fried. Photo: Elmore Roots.

Even in summer, everyone is still connected to spring when the trees open their arms and nearly smother us with delicious blossoms. They feed our eyes and our imagination. They give us hope that things will be good in our world. White, pink, and red puffs of color glow against the full blue sky of northern May skies.

Bees and other pollinators are rewarded from their patience over a long winter with this orchestra of tree colors. Couples walk hand-in-hand under and through the flowering crab trees, whispering to each other. Nests are used, and new ones fly out for the first time. We are reminded that all is possible.

After a few rains, the petals have fallen and the sidewalks are covered with pastels of flowers. Little green apples begin to grow. Most people believe that crabapples are hard little green things that are no good for any-

thing except throwing at walls. On our farm, we have tasted many of them and have discovered some that have amazing fruit in abundance. We call them the "tasty crabapples."

There is the "Kerr crab." Everyone asks if they are dark red plums. On our fruit tasting tours,

we save this for last. As all the changing flavors of apples from tree to tree progress, none has the blend of as many interesting ones as this tasty crabapple. Wine overtones with grape cantaloupe accents dance in the mouth when eating this one.

The "Centennial crab" changes to a rosy pink and is a bit larger and very sweet. It has been described by our customers as cotton candy, apple pie, or apple strudel-like.

The "Dolgo crab" is sometimes called the jelly crab. Old-time Vermonters would make a clear red apple jelly from its apples, straining it through cheese-cloth, and it is high in natural pectin.

The "Chestnut crab" has an orange-red skin. It is crispy and sweet with a flavor that combines pear and apple with a little juicy cider overtone.

Many years we get abundant harvests of these tasty crabapples. They are excel-



Tasty crabapple painting by local artist Gabe Tempesta. Image courtesy of Elmore Roots.

lent for a dessert, a lunch box or a child, as a small apple does not require the hunger or the effort of a large apple. They keep in the fridge for a few weeks, or you can freeze them whole and make sauce, jam, or jelly with them later on in the year, when you have more time.

Tasty crabapples are a perfect homestead tree: they give us a tremendous breathtaking flower show in the spring, and then shower us with a big welcome harvest of useful and delicious fruit. They also are a home to many birds and pollinators and are useful in cross pollination of other apples in the neighborhood.

Many years ago in the middle of winter I visited the UVM horticultural farm in the Burlington area. They used to have

hundreds of crabapples growing there, planted and directed by Professor Norman Pellett. I asked the guys who worked there what was their favorite to eat out of all the many growing there. They pointed to this one tree and said "we don't know what kind it is, but we all like its fruit very much!" I crawled on my belly over the ice and snow looking for an I.D. tag or something. I found an old metal label that said "Chestnut crab." I have been propagating and growing this cultivar ever since.

David Fried runs Elmore Roots Nursery where they encourage their customers to taste and plant tasty crabapples as a good multipurpose fruit tree for our times.

*Bees and other
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rewarded from
their patience
over a long winter
with this
orchestra of
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The mower in action on the side yard where it has trees and gardens to maneuver around. Robomow is seen in the center of the picture. Photo by N.R.Mallery.

depending on the size of the lawn. I have mine set to run from 9 am to 5 pm and not if it is raining more than a drizzle. It can mow in the rain, but also has a rain sensor. There is no grass to rake because the clippings are mulched thoroughly, adding to a healthier lawn and less work for me, too. It goes around obstacles with no problems. It does the edges. And it does this without any help from you. It even knows when and where to charge itself, a job it also does without any assistance.

It uses no fossil fuels! The electricity it uses costs less than \$15 per year (33 kWh/month), and the lithium-ion battery lasts for three to four years and is designed for its daily use.

Robomow makes models for lawns ranging from 1/8 acre to 3/4 acre. Got a bigger yard? No problem. And if your lawn has multiple zones (up to seven of them), you can add another base for additional charging. Hills? The built in tilt-sensor works for up to a 35% slope, about a 20° incline.

There are a number of compelling reasons to use an electrically-powered robotic lawnmower. One is safety. Injuries caused by lawnmowers include contact burns and traumatic lacerations but do not stop there. According to Robomow, insect stings and exposure-related illness, such as heatstroke, prompt a significant number of medical interventions each year. Inhaling exhaust can lead to a number of health issues, including cancer. Another risk we can avoid is skin

cancer from exposure to the sun.

Robomow believes electricity-driven robotic lawns hold the answers to these problems. In fact, the company just announced a Drive to Cut Down Mowing Injuries.

Added bonus: Got free-range chickens? No problem. They get along just fine. In fact, the mower might even scare off the occasional hungry fox or bird of prey.

Robomow has been making mowers since 1995. They have been widely used in Europe for many years. The mower has a one year warranty, and the support is awesome.

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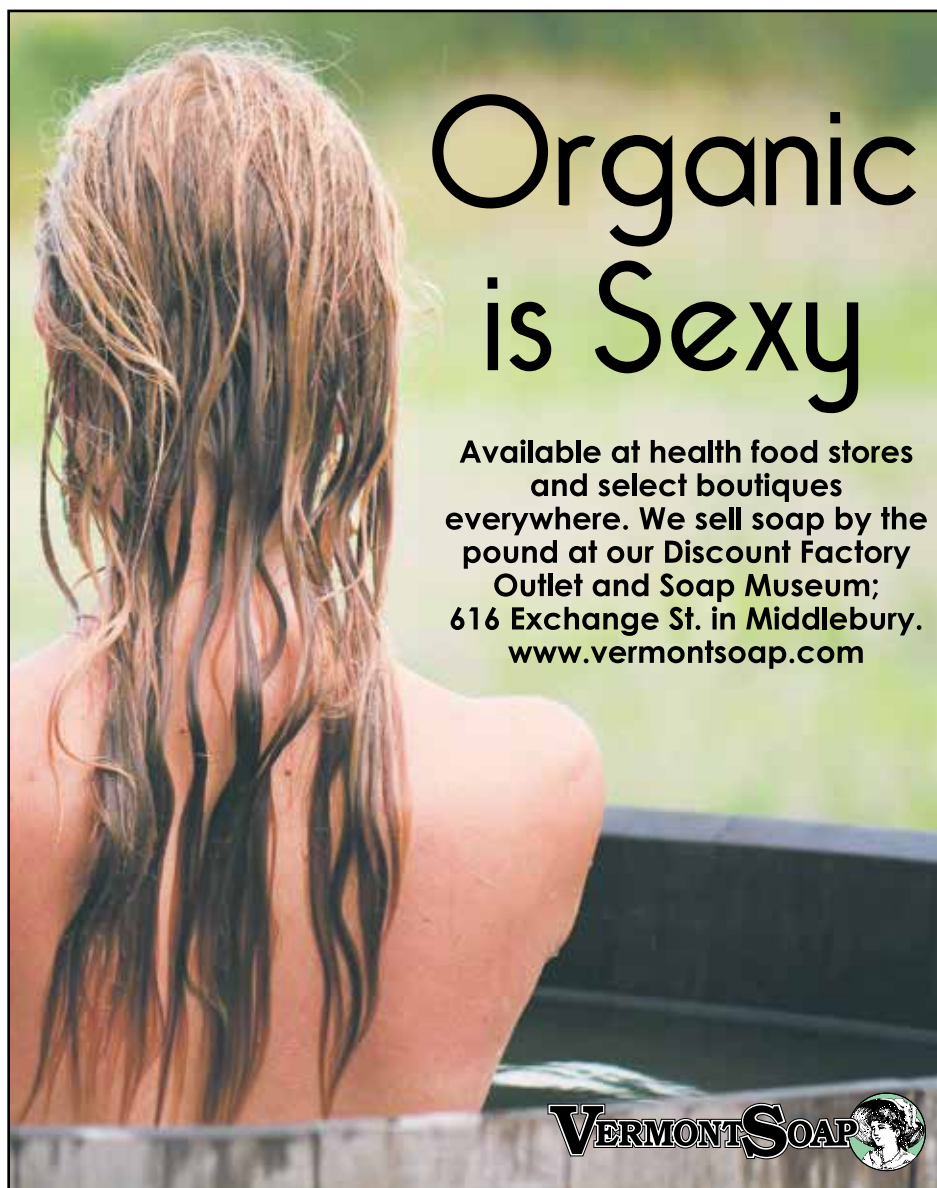


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