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The BUSINESS CASE FOR SOLAR POWER

By George Harvey

"We can help any business save money through solar," Jim Merriam, the CEO of Norwich Solar Technologies asserted. Some business operators have the idea that solar power would not work for them, but Merriam responded to this notion by saying, "Anybody can do this, and anybody can save money. This remains true even if you don't directly own or host the solar array."

Norwich Solar Technologies, located in White River Junction, Vermont, has worked in the solar industry in Vermont and New Hampshire since 2011. As a company specializing in educational, municipal, and commercial facilities, it has done close analysis of the advantages it can bring its customers. One of the results of this work is a report, "The Top 4 Ways Solar Power Can Strengthen Your Business," which is available for download at the company website (https://norwichsolar.com/solar-power-for-business-ebook/). Briefly stated, the top four ways are the following:

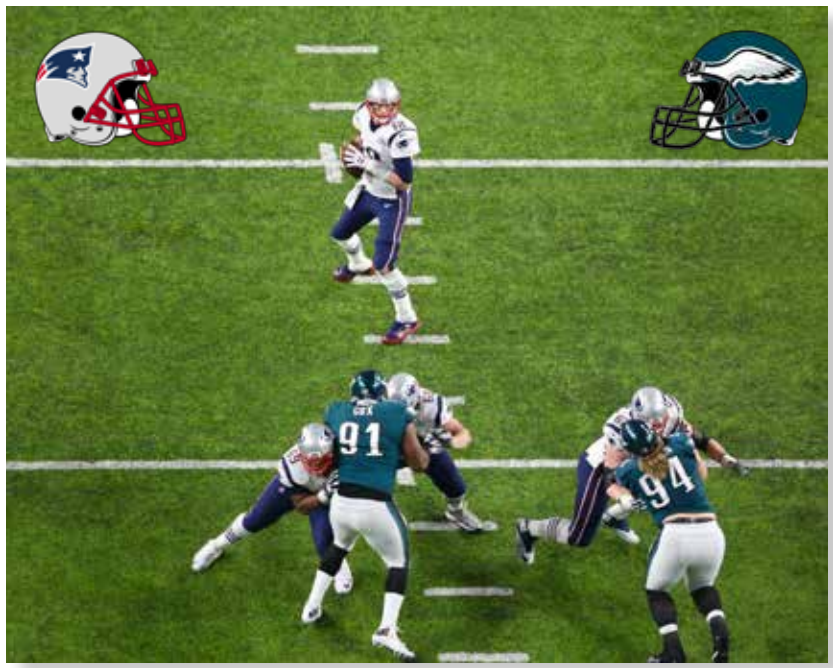
- ✓ Reduced energy costs with long-term stability.
- ✓ Reduced taxes with generous depreciation schedules (up to 100% bonus depreciation) and tax credits (30% of system cost), with an additional 7.2% tax credit for Vermont businesses.
- ✓ Appreciation of an environmentally-sound effort from customers and community members.
- ✓ Increased property value with potential for new revenue streams.

The Upper Valley Aquatic Center's 500 kW off-site, net-metered solar powers this local business. Courtesy Image.

Certainly, with climate change on the minds of many people, it is good to have customers, neighbors, and others in the community aware of the work a business is doing to reduce carbon emissions. Solar installations are an excellent way for any organization to say, "We care, and we are doing our part." And while there are still a few people who object to the appearance of a large solar farm, the number of people who welcome solar systems is increasing as communities get involved and the public awareness of the *Cont'd on p.19*

Who's Really the Winner at the Super Games?

By Chris Gillespie



New England Patriots quarterback Tom Brady drops back to pass in the second half of Super Bowl LII. Image: Brian Allen/Voice of America. Team USA's Andy Newell on Sustainability at PyeongChang 2018 and Beyond. Andy is from Shaftsbury, Vermont. Image courtesy of Andy Newell.

Welcome to the 2018 Sustainability Super Bowl!

Since both the New England Patriots and the Philadelphia Eagles have impressive records when it comes to conserving resources and utilizing renewable energy, we've decided to pit them against each other once more to see which team is truly greener.

Since G.E.T. is based in New England, we'll start with the Patriots:

Patriots Place, the sprawling "super-regional lifestyle destination" adjacent to Gillette Stadium in Foxborough, MA, has more than 2,600 rooftop photovoltaic solar panels as well as solar canopies, which, according to Patriots Place's website, "provide up to 60% of Patriot Place's power and reduce carbon emissions by more than 800 metric tons every year." According to a report from Patriot Place, during the second quarter of 2017, the shopping and dining center conserved nearly 207,000 kWh of electricity, 333,000 gallons of water and 232 metric tons of GHG emissions.

Meanwhile, in Philadelphia, "100% of the Eagles operations are powered by the sun and wind." As stated on the team's website, The Eagles partnered with NRG to design, construct and operate 11,108 solar panels and 14 wind turbines at Lincoln Financial Field. Vigorous waste management, composting and recycling procedures help the Eagles keep over 99% of waste generated in the stadium out of landfills. The Eagles have also planted 568 trees over the past ten years in order to offset emissions caused by all of the team's travel. Lincoln Financial Field is considered to be 'off the grid' as a result of their *Cont'd on p.39*

Sustainable Business 2018

Today's top business trends will have big impacts

By George Harvey

The state of sustainable business appears to be up in the air right now. This is largely because of unclear policy on the part of the governments of the United States and some of the individual states. With opposition to renewable energy, potential investors have difficultly evaluating market risks. They put their funds elsewhere, and this has a somewhat depressing effect on renewable businesses.

What is not clear to some people, even including even some in the field, is that the situation is tilting rapidly in favor of renewable energy. Costs have come down far more rapidly than almost anyone might have predicted, and this drives investment in renewable energy.

Looking beyond our borders, we can see this clearly. In India, for example, the cost of electricity from new renewable sources is lower than that of about two-thirds of the existing coal-burning power plants. In the long run, there is no longer any reason to buy power from most thermal plants.

There are a number of factors that will have effects on the US business situation. These are a few:

1. As outrageous as federal government attacks on science seem to be, the really important issue is what corporate America does. And corporate America has many leaders who evaluate potentials objectively in terms of gains or loss for their companies. There is strong support for fact-based science.
2. Climate change is a very real threat to many investments, regardless of the fact that important politicians push to have it ignored. Conservative Republican leaders in the state of Louisiana, for example, have told people in nearly all coastal areas that they have to be prepared to move elsewhere because of rising seas, the result of climate change, combined with subsiding land, the result *Cont'd on p.38*

IN THIS ISSUE:

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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.

Solar Power works! ... anywhere under the sun!

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Climate Change: What Can I Do?

We feel for our fellow U.S. citizens in southern states, Puerto Rico and the Virgin Islands as well as people living on other islands being hit by storms and the loss of coastal area to rising seas. This will get worse, likely much worse. Much of Florida and other vulnerable low lying coastal regions in Louisiana along with other coastal states will be lost to rising waters. New York state will be hit as well with the rising Hudson River, with losses to Long Island and other shorelines.

Climate refugees are increasing from Africa, Middle East, Asia and island nations. Where do they go? Aren't they already heading to mainland U.S.?

If you lived in Puerto Rico or the Virgin Islands, would you rebuild there? Wouldn't you take your insurance settlement and seek higher ground in the U.S. to build on?

With long range forecasting predicting more super hurricanes with higher storm surges and greater rainfalls, rising seas and higher tides, my supposition is that millions from the Caribbean and Central America will relocate to the U.S. mainland.

New York state and New Jersey are already home to large Puerto Rican, Caribbean, and Central American communities. Many will come here. Others will scatter from Florida on up the east coast. U.S. mainland population will rise along with demand for housing, services and protection.

Can we do anything to help? To remediate the slowly rising temperatures and this slowly escalating crisis?

No matter the cause, global temperature rise is happening. Can we slow that down or turn it around? Shouldn't we try? I am. It hurts nothing to try to be part of the solution.

— Ken Stokem, Castleton, New York

Green Energy News You May Have Missed

By George Harvey

As usual, the climate has been one of the most important news items of the past two months. There is bad news, which is that 2017 was the second hottest year on record, worldwide, after 2016, which was an El Niño year. While we in the Northeast might have had the impression that it was cooler than normal, that was due to unusual weather patterns that did not reflect what was happening nearly everywhere else. For the month of December, the average temperatures in the entire state of Alaska were 15.7° F above normal.

Worse yet, 2017 was the warmest year on record for ocean waters. As water warms, it also expands, and this adds considerably to the rise of sea levels caused by melting glaciers. Satellites measurements have shown that the sea levels are rising at almost exactly the rate predicted by climate scientists' computer models.

We have also seen news of slowdowns in construction of renewable projects nationwide due to uncertainty over hostile government policy. In Vermont, 232 full-time jobs were lost in the solar industry alone in a twelve-month period ending in November 2017, according to the Solar Foundation's National Solar Jobs Census.

There is quite a lot of confusion over how the economics of solar power will go, since the president chose to impose a 30% tariff on solar panels imported from most producing countries, including China, Japan, South Korea, Taiwan, the Philippines, Mexico, and Canada. One of the effects of this has been that Chinese manufacturers have decided to build factories in India, which is one of the countries whose products are not subject to the tariff. More importantly, however, the tariff means that there will be increased prices on solar panels in the United States.

The increased taxation is largely being offset by falling prices of solar cells, which have fallen worldwide to new lows. In fact the latest information from Bloomberg New Energy Finance indicates that prices for new photovoltaic modules have fallen to levels that were almost unimaginable only a year ago. The cost of PVs have become only a small fraction of the total cost of installation. The prices of solar installations might not increase much after all, and the economics of solar power will almost certainly remain attractive. It is too early to see how this will play out.

Vermont Green Business

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PUT A PRICE ON POLLUTION - *What Is the ESSEX Plan?*

By Michael Shank

Economists love it. Republicans love it. Democrats love it. Big multinational corporations love it. Even activists love it. What could possibly garner that much affection?

A pragmatic piece of policy that puts a cost on carbon and a price on pollution. It's clean and simple. And in Vermont we have an opportunity to make it a reality.

The reality is that we are already paying mightily for carbon as taxpayers. According to the International Monetary Fund, governments worldwide will pay well over $5 trillion in just one year for carbon's costs. That includes direct subsidies to fossil fuel companies as well as costly environmental cleanups and deadly health impacts. Pollution is expensive and the cleanup cost is consistently covered by taxpayers, not the companies profiting from that pollution.

If you think that's an absurd arrangement, you're not alone. The Economist Magazine editorial board has consistently called for polluters to pay by putting a price on carbon – as have President George W. Bush's Treasury Secretary Hank Paulson and former Secretaries of State James Baker III and George Shultz. Billionaire and former New York City mayor Mike Bloomberg has been calling for a price on carbon for over a decade. And even ExxonMobil, Shell and BP support one.

These Republicans, economists and multinational corporations all understand that from a market perspective you should put a price on whatever you want less of (e.g. pollution) and support or subsidize whatever you want more of (e.g. renewable energy) – not the other way around, which is what we're currently doing in America. And the public supports this notion, too. The overwhelming majority of American citizens want to regulate carbon dioxide as a pollutant. Poll after poll keeps telling us this. So, let's do it.

National Republican leaders, named above, have suggested starting at $40 a ton and increasing over time. Why $40 per ton? That's the scientifically calculated cost borne by society for each ton of carbon. It's time we share that burden more fairly.

The ESSEX Plan, which is the Vermont statewide campaign to put a price on pollutants, backed by Seventh Generation, Ben & Jerry's and key environmental organizations, begins the pricing of pollutants at a rate of $5 per ton in 2018 and increases by $5 per ton each year until the price reaches $40 per ton. While $5 may seem small compared to what Republicans above are calling for, in the first year of implementation, the ESSEX Plan would generate $30 million in electric-rate reductions.

That's a lot of money and illustrates the real win-win of such a plan. Those monies go straight back to Vermonters, providing residents and businesses with significantly lower electricity rates (i.e. 27% lower commercial and industrial rates), as well as rebates for families who need extra support. For example, families of four earning less than $90,000 a year, as well as rural Vermonters earning less than $75,000 individually, would get additional monthly rebates, lowering their electricity costs or travel expenses even further.

What Vermont does with the reduced carbon pollution is the biggest win. Vermont's share of the over 200,000 American deaths each year due to air pollution is not insubstantial. Over 200 Vermonters die needlessly each year thanks to the burning of fossil fuels, according to MIT. The ESSEX Plan cuts Vermont's pollution by up to 25% in less than 10 years and by up to 50% in less than 35 years. In doing so, we save lives and money. For each Vermont life saved, versus one lost to a pollution-caused death, the estimates on the productivity gains – by keeping Vermonters healthy, free from dirty pollution, and contributing to society – range from hundreds of thousands to millions of dollars. This clear economic argument for kicking dirty carbon to the curb is surpassed only by the moral argument for keeping people alive.

But the gains do not stop there. The state is currently spending between $1 billion and $2 billion each year on fossil fuel-based products. Thus, incentivizing Vermont through market mechanisms to move away from polluting products and toward a cleaner economy will be money better spent. Instead of $1 billion to $2 billion spent on products that threaten our air and water and harm our health, and require state-sponsored cleanup, those monies can instead be spent on generating thousands of new jobs in the state – up to 6,000 to be exact.

While Vermont should be lauded for maintaining America's highest%age of low-carbon electric generation, Vermonters can do better. If we want all Vermont utilities to reach the required 75% renewable energy goal in 15 years, for example, we need to lead the market transformation – and now. In doing so, we can also show the country how it's done and lead where few states have led before. Americans are desperately looking for national and international leadership on the climate front, and Vermont has an opportunity to seize that stage and send a strong message to polluters.

There's a reason why over 80% of expert economists think a market-based system (such a price on carbon) is the most economically efficient method of reducing carbon pollution. They understand the importance of market forces and support putting a price on anything that comes with negative spillover effects, such as air pollution, and investing in that which has positive multiplier effects, such as renewable energy. It's that simple and that sensible. The ESSEX Plan moves us in that direction and makes clear that pollution no longer gets a free pass. It's time to put a price on it

Michael Shank, Ph.D, is a resident of Brandon, VT and is the communications director for the Carbon Neutral Cities Alliance and the Urban Sustainability Directors Network. This article originally appeared on VTDigger.com at https://vtdigger.org/2017/12/10/michael-shank-put-price-pollution/.

Links available in online posting of this article at www.greenenergytimes.org. ♻

100% Renewable Energy Worldwide Isn't Just Possible—It's Also More Cost-Effective

By Lorraine Chow, EcoWatch

Reposted from EcoWatch media associate AlterNet.

Transitioning the world to 100% renewable electricity isn't just some environmentalist pipe dream—it's "feasible at every hour throughout the year" and is more cost-effective than the current system, which largely relies on fossil fuels and nuclear energy, a new study claims.

The research, compiled by Finland's Lappeenranta University of Technology (LUT) and the Berlin-based nonprofit Energy Watch Group (EWG), was presented Wednesday at the Global Renewable Energy Solutions Showcase, a standalone event coinciding with the COP 23 climate talks in Bonn, Germany.

The authors said that the existing renewable energy potential and technologies coupled with storage can generate enough energy to meet the global electricity demand by 2050.

The researchers estimated that the switch will bring the total levelized cost of electricity on a global average down to €52 ($61) per megawatt-hour (including curtailment, storage and some grid costs) compared to €70 (82) per megawatt-hour in 2015.

"A full decarbonization of the electricity system by 2050 is possible for lower system cost than today based on available technology," said Christian Breyer, the lead author of the study.

"Energy transition is no longer a question of technical feasibility or economic viability, but of political will," added Breyer, who is also a professor of Solar Economy at LUT and serves as chairman of EWG's Scientific Board.

According to the study, solar power and battery storage are critical parts of the transition. Falling prices will also lead to widespread adoption of the technologies. The researchers predict that the globe's electricity mix by 2050 will consist of solar photovoltaics (69%), wind energy (18%), hydropower (8%) and bioenergy (2%).

By following this path, greenhouse gas emissions in the electricity sector will come down to zero and drastically reduce total losses in power generation, the study found. Not only that, the renewable energy transition would create 36 million jobs by 2050, 17 million more than today.

"There is no reason to invest one more dollar in fossil or nuclear power production," EWG president Hans-Josef Fell said. "Renewable energy provides cost-effective power supply. All plans for a further expansion of coal, nuclear, gas and oil have to be ceased. More investments need to be channeled in renewable energies and the necessary infrastructure for storage and grids. Everything else will lead to unnecessary costs and increasing global warming."

This is the not the first time researchers have suggested that the planet's road to 100% renewables is possible. Earlier this year, Stanford University professor Mark Jacobson and 26 co-authors published a study and created clean energy roadmaps for 139 individual countries. The chosen countries emit more than 99% of all carbon dioxide worldwide.

Here are the key findings of the current study:

• Existing renewable energy potential and technologies, including storage, can generate sufficient and secure power to cover the entire global electricity demand by 2050. The world population is expected to grow from 7.3 to 9.7 billion. The global electricity demand for the power sector is set to increase from 24,310 TeraWatt hours (TWh) in 2015 to around 48,800 TWh by 2050.

• Total levelized cost of electricity (LCOE) on a global average for 100% renewable electricity in 2050 is €52/MWh (including curtailment, storage and some grid costs), compared to €70/MWh in 2015.

• Due to rapidly falling costs, solar PV and battery storage increasingly drive most of the electricity system, with solar PV reaching some 69%, wind energy 18%, hydropower 8% and bioenergy 2% of the total electricity mix in 2050 globally.

• Wind energy increases to 32% by 2030. Beyond 2030 solar PV becomes more competitive. The solar PV supply share increases from 37% in 2030 to about 69% in 2050.

• Batteries are the key supporting technology for solar PV. The storage output covers 31% of the total demand in 2050, 95% of which is covered by batteries alone. Battery storage provides mainly diurnal storage, and renewable energy based gas provides seasonal storage.

• Global greenhouse gas emissions significantly reduce from about 11 GtCO2eq in 2015 to zero emissions by 2050 or earlier, as the total LCOE of the power system.

• The global energy transition to a 100% renewable electricity system creates 36 million jobs by 2050 in comparison to 19 million jobs in the 2015 electricity system.

• The total losses in a 100% renewable electricity system are around 26% of the total electricity demand, compared to the current system in which about 58% of the primary energy input is lost.

The research was co-funded by the German Federal Environmental Foundation and the Stiftung Mercator. ♻

Are Electric Vehicles and Solar Threats or Saviors to Utilities?

By Randy Bryan

Electric utilities have resisted renewable power (solar) growth in various ways over the years. Many utilities have seen solar installations as a threat to their legacy business model (monopoly-regulated-safe central supply to secure growing customer base). Solar has been a distributed ad hoc supply source, bleeding demand away from the central generating stations, while creating riskier supply. Utilities have feared this as the early stage of a death spiral where their constant expense base must be paid for by ever less revenue and fewer customers. The business response is to contain the solar problem to a token percentage of business (restricting net metering and incentives) and/or to raise rates on the fewer customers remaining. However, raising rates would cause even more customers to leave and/or augment their power supply causing a death spiral.

The dropping cost of solar and wind energy and batteries make renewables equal or lower cost than utility power, even without incentives. Batteries allow solar power to be demand-driven (base load) rather than supply-driven (when the sun shines or wind blows), which may enable customers to leave the utility completely to go "off-grid."

This business view has been widely reported and discussed within the industry. I believe this "death spiral" fear is completely wrong and is, in my view, a self-conjured danger. In fact, another recent technology trend may make solar a savior of the utilities, rather than their demise. That new trend is electric transportation (electric cars, trucks, and buses).

To build my case, I offer some background information:

The typical home solar installation is about 5kW, yielding about 15kWh of energy in a day. The average house load is about 20-25 kWh per day. So, on average, where houses/businesses can have solar, solar energy supply potential is less than existing building demand. And don't forget, many sites cannot deploy solar due to roof availability such as orientation, shading, or neighborhood restrictions.

Enter the electric vehicle, ready or not. Electric vehicles are only about 1% of the vehicle market now. But, their market growth is expected to mushroom (about 25-30%/year), equaling 15% by 2025 and 25-30% by 2030, eventually replacing combustion vehicles all together. This automotive industry prediction is due to the falling cost and growing capabilities of batteries, the lower cost to manufacture electric cars versus combustion cars, and the lower operating costs of electric cars (less maintenance and lower cost of electricity per mile). Added to this cost case is the growing list of countries, states, cities, and companies mandating all electric vehicles fleets by some future date, to the exclusion of combustion vehicles.

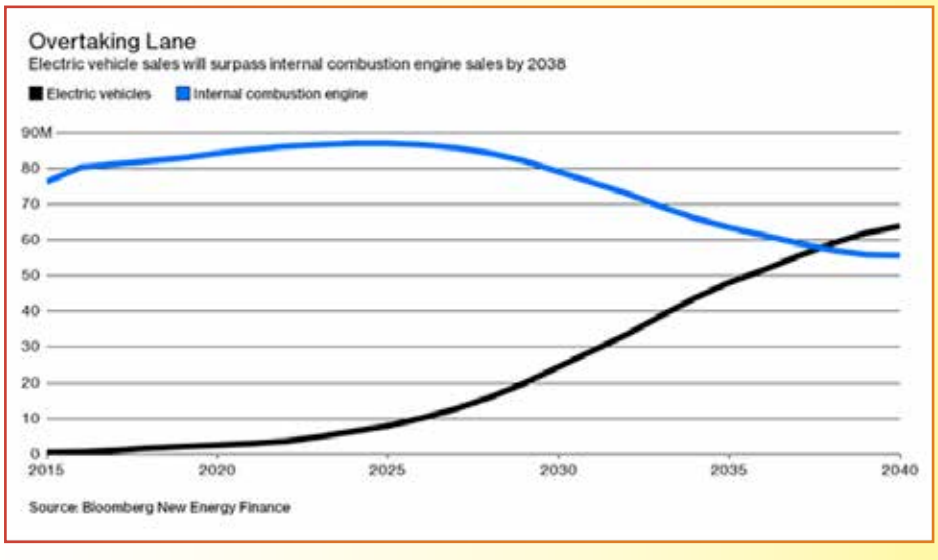
The typical electric car will need sufficient battery capacity to travel 300-400 miles per charge (100-150 kWh). But, most people average about 50 miles per day (15-20kWh) in their primary car and maybe half that for a second car. To put it another way, the primary (electric) car will add about a new house worth of load and the second (electric) car about a half house. Much of this charging will occur at night, at home. For longer range driving needs, or electric cars without a convenient nighttime charger, other day-time charging supply will be needed, likely in the form of gas-station/parking-lot-like charge sites, which will serve about 20% of the overall transportation charging needs.

To summarize my case, electric vehicles will cause a significant increase in overall electric demand (up to 50% more, if all vehicles are electric). Most (80%) of the demand will occur at night, with rate incentives, and generate additional revenue from existing grid assets, perhaps stabilizing grid rates. Where vehicle charging is needed, external power supply will most certainly be needed, assuring the continuing and growing need for utilities' power.

The day-time charging needs of electric vehicles could significantly boost the prime-time power or energy demand and overwhelm the grid as currently built. A potential solution is to ramp up solar power installations (with battery for some buffering) as a clean and local source of energy that closely matches the added day-time charging loads of electric vehicles. Throttling of vehicle to grid connections is a second order issue and a separate discussion.

I suggest that electric utilities will be saved, not ruined, by electric vehicles and solar power. And they go together. As such, utilities should become active advocates for both electric vehicle sales and solar installations, as the best, cleanest, and safest course toward a profitable and reliable grid future.

Randy Bryan has been an advocate for electric cars for 8 plus years. His company, ConVerdant Vehicles, has converted vehicles to plug-in hybrids, including his own Prius in 2008, and developed and sold inverters that turn a Prius into an emergency generator. He is one of the co-founders of Drive Electric NH. ♻



Drive Electric Vermont

State Electric Car Incentives

Coming to Vermont Soon?

By David Roberts

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

Many states are looking to give EVs a boost through their spending plans for their VW diesel settlement funds. States may spend up to 15% of their settlement proceeds on EV charging stations, with the remaining 85% available to help support heavy duty electrification of trucks and buses. In Vermont, members of the state legislature have introduced a bill (H. 682) which would direct the state's beneficiary, the Agency of Natural Resources, to invest these settlement funds exclusively in electric-powered options.

For many individuals the cost of an EV remains the most difficult barrier to ownership. Federal, state and electric utility purchase incentives are helping bring down this cost. Many northeast states are among those offering EV purchase incentives, but a few have run out of funding for incentives or not offered them in the first place. The table shows more details on currently available state incentives.

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

Vermont does not currently offer a state incentive, but two bills are under consideration in the Vermont House and Senate which could change that. These bills include several provisions related to EVs, including a sales tax waiver on EV purchases, added EV fees for highway infrastructure in lieu of gasoline taxes, planning for more charging infrastructure, and exploring ways utilities and regulators can help maximize the economic value of the transition to EVs for the grid.

The Senate bill (S. 271) calls for waiving the 6% state sales tax on the first $30,000 of an all-electric vehicle or the first $15,000 of a plug-in hybrid, reducing EV purchase costs by up to $1,800. The House bill (H.778) would completely exempt both types of electric cars from any sales tax.

The Senate bill also calls for imposing a supplemental registration fee on plug-in electric vehicles of $100 for all-electric vehicles and $50 for plug-in hybrids to make up for lost gasoline taxes. The proceeds of this fee would be split between transportation infrastructure funding and the state Clean Energy Development Fund to go toward building out more charging infrastructure.

The House bill takes a slightly different approach to making up for lost gas taxes by establishing a 1 cent per kilowatt hour surcharge on EV charging to be contributed into the transportation infrastructure fund starting in 2020. The bill would also support EV charging through a state income tax credit of up to $7,200 on a new charging station installation.

You can learn more about these bills and their status in the Vermont Statehouse at the links below, or by getting in touch with your legislator – especially if you're interested in providing feedback on the proposed incentives, fees and studies.

https://legislature.vermont.gov/bill/status/2018/H.778

https://legislature.vermont.gov/bill/status/2018/S.271

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

Share a RiDE. WaLK. BiKe. TaKe a BuS...

SMART COMMUTING IN NH & VT

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

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

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

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

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

IN NEW HAMPSHIRE

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

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

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

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

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

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

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

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

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

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

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

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

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

IN VERMONT

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

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

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

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

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

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

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

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

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

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

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

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

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

CHRYSLER PACIFICA PHEV

First Affordable Electric Car for Families

By David Roberts

The quiet thrill of driving electric is reaching new territory this year with the arrival of the Chrysler Pacifica Hybrid. This is a seven passenger minivan that goes 33 miles on the battery and up to 570 miles on a full battery and a tank of gas. The plug-in hybrid version is rated at 84 miles per gallon equivalent – a huge improvement over the standard Pacifica's 22 mpg.

Frugal households will enjoy paying the equivalent of about $1.50 per gallon of gas when driving on the battery and may even be able to skip visits to the gas station all together if most daily travel is within range of the battery. Charging is as easy as plugging into a standard 120 volt outlet overnight or installing a dedicated 240 volt unit for faster charging. Owners will save on maintenance too, with longer intervals between expensive maintenance items like brake jobs.

Early reviews are giving the Pacifica top marks due to the excellent handling, family-friendly features and efficiency. With a starting price of about $32,500 (after the $7,500 federal tax credit), it is less than the average new car today, and you may qualify for additional state or electric utility incentives that bring the cost down further. Many utilities are also offering lower electricity pricing for charging during off-peak hours to save you even more for the life of the vehicle.

The battery is located along the bottom of the vehicle, giving this front-wheel drive model excellent traction in winter weather – especially if you invest in winter tires. About the only thing missing are the "Stow and Go" seats which fold into the floor on the non-hybrid model. You can still move the seats, but will need to take them out of the vehicle if you want to completely open up the cargo area for large objects.

The Pacifica is the only minivan earning a Top Safety Pick from the Insurance Institute for Highway Safety and is available with crash prevention technology like blind spot alert and forward collision warning systems. In addition to the safety technology, it also comes standard with Apple CarPlay and Android Auto to make it easier to navigate and listen to your favorite tunes in the car.

The flexibility of the plug-in hybrid system means you never need to worry about running out of charge on the road and with room for kids, dogs and cargo this is a great option for van shoppers to consider. It is now available at Chrysler dealers across the country, with many dealers in the northeast keeping one on hand for test drives.

You can learn more about the Pacifica Hybrid on the Chrysler website: https://www.chrysler.com/pacifica/hybrid.html

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

Affordable Tech Marvels Dominate Greenest Vehicles List

For those who like clean vehicles with state-of-the-art technology, or simply want to reduce their environmental footprint, today's market has good news. A variety of affordable, efficient, tech-smart cars and trucks are now on the market, giving American consumers plenty of options for buying a greener vehicle. At greenercars.org, the American Council for an Energy-Efficient Economy (ACEEE) released its 21st annual GreenerCars vehicle ratings to help consumers make that choice.

For the second year, the mid-sized Hyundai Ioniq Electric takes the top spot on the Greenest List, achieving the highest-ever Green Score of 70. The Ioniq brings high efficiency in a practical size, earning its place at the top of our Greenest List. The Mercedes-Benz Smart Fortwo Electric Drive, BMW i3 BEV, Kia Soul Electric, Ford Focus Electric, and Honda Clarity also earn places among the greenest vehicles for sale today.

Perhaps the most buzzworthy automotive news of the last year was the introduction of the all-new Tesla Model 3, which joins the Chevrolet Bolt (ranked sixth) as the second electric vehicle (EV) that consumers can purchase for less than $40,000 (before tax credits) and drive more than 200 miles on a full charge. The Model 3 Long Range claims the fourth spot with a score of 67.

The following vehicles make up the Greenest List for 2018, representing the most environmentally friendly cars for sale today. Each car is given a Green Score based on an environmental damage index (EDX), which reflects the cost to human health from air pollution associated with vehicle manufacturing, the production and distribution of fuel, and vehicle tailpipes.

Greenest	Green Score
1. Hyundai Ioniq Electric	70
2. Mercedes-Benz Smart Fortwo Electric Drive	69
3. BMW i3 BEV (94 Ah)	68
4. Tesla Model 3 Long Range	67
5. Kia Soul Electric	66
6. Chevrolet Bolt EV	66
7. Hyundai Ioniq Blue	65
8. Toyota Prius Eco	64
9. Ford Focus Electric	64
10. Kia Niro Plug-in Hybrid	63
11. Honda Clarity Plug-in Hybrid	62
12. Chevrolet Volt	62

The automotive industry is producing a variety of cars and trucks with highly efficient electrified drivetrains. Electrified drivetrains incorporate an electric motor and battery, driving entirely on electricity in the case of a pure EV, or in conjunction with a traditional gasoline or diesel engine in the case of hybrids and plug-in hybrids.

"Automakers have brought an impressive number of highly efficient vehicles to market, giving American consumers more choices, whether they are looking for a compact car or a fully-loaded pickup," said Eric Junga, Transportation Research Analyst at ACEEE. "And as electric vehicles become more affordable and more enticing thanks to increased range and state-of-the-art features, sales are really picking up steam."

Hybrids also make an appearance on the Greenest list, with Toyota's Prius lineup and Hyundai's Ioniq hybrid variants performing well. The Kia Niro plug-in hybrid, using the same drivetrain as the Ioniq, and the Chevrolet Volt plug-in with an impressive 53-mile electric-only range, both return to the Greenest List, as well.

For the third consecutive year, the Greenest List is populated completely by vehicles with some form of electric powertrain and contains no vehicle with an internal combustion engine (ICE) alone. Manufacturers have made impressive strides in the efficiency of ICEs, but adding a small degree of electrification can further reduce environmental impact over the life of a vehicle. Even when considering the emissions from the production of batteries, electrified cars and trucks take claim as the most environmentally friendly vehicles available today.

Greenercars.org also identifies practical options in each class among the top widely available automatic transmission gasoline or diesel models, because vehicles on the Greenest list may not meet the needs of every individual or may not be widely available. The Greener Choices List includes both conventional vehicles and traditional hybrids, but excludes plug-in hybrids and pure battery electric vehicles that require the availability of a charger to maximize efficiency.

The Greener Choices list demonstrates that consumers can make greener choices, even if their vehicle needs aren't met by those on the Greenest List. The new Toyota Camry Hybrid, which just misses the Greenest List, shows up on the Greener Choices list as a high-scoring option for buyers looking for a mid-size car. Greener Choices also highlights green options for trucks and SUVs for those buyers who need the extra space, including the rear-wheel-drive 2.7-liter Ford F-150 and Honda CR-V.

The Chevrolet Colorado/GMC Canyon Diesel earned a score of 42, and the Chrysler Pacifica minivan returns with a score of 41. While plug-ins are excluded from Greener Choices, it's worth noting that the Pacifica plug-in hybrid option scored an impressive 55 and is cost-competitive with the gasoline-only version when federal incentives are factored in.

Greenercars.org also provides a Meanest List, populated this year - as usual - by large SUVs, well-equipped pickup trucks, heavier medium-duty vehicles, and European luxury cars that are the least friendly to the environment.

Green Scores of the 1,500-plus configurations of all model year 2018 vehicles are available for free in the greenercars.org interactive database, along with each configuration's fuel economy, health-related pollution impacts, and greenhouse gas emissions. Visitors to the database can build custom lists for comparing vehicles. Greenercars.org also features a write-up on model year 2018 market trends, a consumer primer on vehicles and the environment, and advice on how to buy green when shopping for a new car or truck.

Updates to this year's methodology include new estimates of emissions associated with electricity production, as well as updated emissions from the manufacturing and recycling of vehicles.

To read the news release online, visit http://bit.ly/ACEEE_GreenCars2018.

The American Council for an Energy-Efficient Economy (ACEEE) acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. For information about ACEEE and its programs, publications, and conferences, visit aceee.org.

Greener Choices	Vehicle Class	Green Score
1. Toyota Camry Hybrid LE	Midsize car	62
2. Kia Niro FE	Small wagon	61
3. Toyota Prius C	Compact car	61
4. Ford C-Max Hybrid	Large Car	55
5. Toyota Yaris iA	Subcompact Car	55
6. Nissan Rogue Hybrid	Medium SUV	52
7. Honda CR-V	Small SUV	50
8. Mercedes-Benz GLA250	Medium Wagon	48
9. Lexus RX 450h	Large SUV	46
10. Chevrolet Colorado / GMC Canyon Diesel	Compact Pickup	42
11. Ford F-150 Base Payload	Standard Pickup	41
12. Chrysler Pacifica	Minivan	41

Meanest	Green Score
1. Mercedes-Benz G550	19
2. Mercedes-Benz AMG G65	22
3. Mercedes-Benz AMG G63	25
4. Jeep Grand Cherokee TrackHawk 4x4	25
5. Toyota Sequoia FFV	27
6. Toyota Tundra FFV	28
7. RAM 1500	28
8. Lexus LX 570	28
9. Nissan Armada	28
10. Mercedes-Benz AMG GLS63	28
11. Toyota Land Cruiser Wagon	28
12. Dodge Durango SRT	28

Two Big National Wins for Reducing Fossil Fuel Use – For Geothermal and Building Efficiencies!

Geothermal Heat Pump Tax Credits and 179D Commercial Buildings Energy Efficiency Tax Deduction Approved by Congress

On February 9, 2018, the U.S. geothermal heat pump (GHP) industry scored a victory for its workforce as federal legislation was passed to extend federal tax credits for residential and commercial installations of GHPs. The measure was included in the continuing resolution spending bill approved by Congress.

The reinstated GHP tax credits are retroactive to January 1, 2017, and extend to January 1, 2022. The language also changes an important consideration for commercial GHP projects, making them eligible if commenced by January 1, 2022 rather than placed in service.

"Today's action by Congress finally fixes the inequity created two years ago when tax credits for solar installations were extended through 2021," stated Geothermal Exchange Organization (GEO) President and CEO Doug Dougherty. "Credits for technologies including GHPs, fuels cells, microturbines, small wind and combined heat and power were left to expire at the end of 2016."

In addition to reinstating the GHP tax credits, the EPAct 179D (Commercial Buildings Energy Efficiency Tax Deduction) which enables building owners to claim a tax deduction for installing qualifying systems and buildings, has been retroactively extended to include projects completed in 2017. This tax deduction of $1.80/s.f. is available to owners of new or existing buildings who install (1) interior lighting; (2) building envelope, or (3) heating, cooling, ventilation, or hot water systems that reduce the building's total energy and power cost by 50% or more in comparison to a building meeting minimum requirements set by The American Society of Heating, Refrigerating and Air-Conditioning Engineers. Deductions of $0.60/s.f. are available to owners of buildings in which individual lighting, building envelope, or heating and cooling systems that partially qualify by meeting certain target levels. ♻

What's Up With this Solar Tariff Deal, Anyway?

By George Harvey

Green roof on PS 41 in Greenwich Village. Photo by Aloha Jon, Wikimedia Commons.

The United States will impose a 30% tariff on imported solar panels. The tariff comes about because of complaints from two companies with U.S. factories, both claiming that Chinese competition is unfair. One, Suniva, is a bankrupt subsidiary of a Chinese company. The other, SolarWorld Americas, is a subsidiary of a bankrupt German manufacturer.

Contrary to what many people have thought, this case is not about illegal or unfair trade practices in China. Zachary Shahan made this clear in a post at CleanTechnica.com, in which he said, "The new tariffs have nothing to do with dumping or Chinese subsidies or China doing anything unfair or illegal. The new solar tariffs are being put on Chinese solar cells and solar panels only because they are cheap and two solar companies claim they have been seriously harmed by the imports."

In fact, the tariffs were placed on all imported solar cells and panels, with specified countries' products exempted. Notably, the countries whose solar products are subject to the tariff include all major U.S. suppliers, Germany, China, Italy, and Japan, along with such trading allies as South Korea, Taiwan, the Philippines, Canada, and Mexico.

Last August, the attorneys representing Suniva and SolarWorld claimed that imposing a tariff on solar panels would create nearly 115,000 jobs in the US, including 45,000 manufacturing jobs, some portion of which would be making solar panels. Somehow, they envisioned increasing the costs of solar panels having the effect of increasing other jobs related to the U.S. solar industry by over 65,000. I find this impossible to believe.

The Solar Energy Industries Association (SEIA) said there are only about 1,000 people working on making solar panels in the U.S. It also said that increasing the costs of panels will have a depressing effect on the solar industry. It calculated the job losses at 88,000 from the solar industry, mostly installers. While other organizations calculate other numbers, some of them much lower, the tariff does not appear to bode well for U.S. employment.

While the tariffs on solar panels will probably increase the prices of most solar systems in the U.S., they will have the no immediate effect on the rest of the world. In 2017, world installations of solar panels came to about 85,000 MW. About 52,800 MW of this was installed in China. By contrast, according to the Federal Energy Regulatory Commission, the U.S. installed 6,295 MW of solar panels in the first eleven months of the year.

Even given that December's additions are usually very high, it is hard to imagine that U.S. installations could be even 10% of the world total for the year. China, by contrast, used up over 62% of the panels produced in the world, over six times as much as what the U.S. installed.

The thing that makes this particularly bitter is that it is entirely our own fault. While China was supporting its renewable industries and reducing pollution, the U.S. was questioning the value of renewables, ignoring climate change, permitting increased pollution, and putting efforts into fracking.

Part of the bad news is that the tariff really does not right a wrong, and since that is the case, its only effect is to provide temporary support for uncompetitive businesses. It makes those companies' products more able to compete in the U.S. market, but it will not help them get ready to sell in the rest of the world.

There is some good news in all of this. The tariff covers 30% of the cost of the solar panels. Since the panels are probably about 25% to 40% of the total system cost, the increase is only about 7.5% to 12% of the overall cost. This means that the cost of a system is still probably lower than it would have been a year ago, while the price of natural gas is rising. Solar installations are already clearly saving money in most circumstances, and they will continue to do so.

Another thing to consider is the backlash against the tariffs in this country. Under the leadership of the Rocky Mountain Institute, a large number of organizations are getting together intentionally to reduce the costs of solar installations in this country. At least some of the ideas floated in the early part of this effort include increased local assembly.

The tariffs will hurt someone. They will probably have nearly no effect on China. We can only wait to see who has been hurt and how much. ♻

No Grid - No Problem!

Tom Dunne and Mary Hodgkin's solar home. Courtesy photos: Pika Energy Company of Westbrook, Maine.

Around 1.2 million homes and businesses in the Northeast lost power recently after severe weather brought high winds and heavy rains through the region. It just so happens that Tom Dunne and Mary Hodgkin recently installed solar panels through ReVision Energy that was connected to the Maine-made Pika Energy Island with a Harbor smart battery.

Here is an interesting interview by the folks at ReVision Energy with this couple about how well things worked out for this Maine couple during the recent trying times when the power went down, and the power outages that occurred throughout the Northeast. They were happy to talk about how they weathered the storm.

RE: *So, like many others, your neighborhood lost power in the recent storm?*

Tom: Yes, and we actually lost power the week before the storm for about two hours. We were sitting having dinner and didn't know for a few minutes – no flicker, nothing.

RE: *Your battery kicked in and did the job?*

Tom: Sure did – it was our first outage since the installation, and we were happy to see that the elements designated to be powered with the backup were indeed working. Same story after the wind storm we just had.

RE: *It's nice you could test it out before the big storm outage! How's it going now?*

Tom: We were without power from early Monday until 6 pm Saturday, and the solar was able to keep up with our needs. The Pika Energy Island allows us to monitor our consumption, so we can adjust our usage as is appropriate. The battery got down to about 75% one night before refueling with solar electricity the following day.

RE: *How would you grade your "islanded" solar + battery Pika system?*

Tom: In meeting our primary objective of providing a sound solution during an outage, the battery and solar gave a strong "A" performance.

RE: *Are your neighbors aware you have backup power? What do they think?*

Tom: Well, a nice side benefit of the reliable backup is that we were able to store

Cont'd on p.15

NH's Largest Solar Array Goes Online

By Barbara Whitchurch

With the Ossipee Mountains in the background, the state's largest solar array is making energy at Moultonborough Neck where the New Hampshire Electric Co-Op has finalized the construction of a two-megawatt system. (John Koziol)

In an article published in the *New Hampshire Union Leader* on December 25, 2017, correspondent John Koziol described the efforts of the New Hampshire Electric Co-op in Moultonborough to bring the state's largest solar array online, an effort he described as "close to success."

Today, the NHEC Moultonborough Solar Project, the state's largest solar PV array, is online and producing power. The 2 MW array features 7,200 panels over 12 acres of land in Moultonborough, New Hampshire near an NHEC substation off Shaker Jerry Road on Moultonborough Neck.

According to co-op spokesman Seth Wheeler, the electricity generated at the site is enough to power approximately 600 homes, including 84,000 members in 115 cities and towns. NHEC plans to use the array to help offset peak power costs, as well as save on transmission and capacity costs. It will also provide an opportunity for the company to explore utility scale battery storage programs. NHEC is a member-owned electric distribution cooperative serving 84,000 homes and businesses in 115 New Hampshire communities. It is currently the largest solar electric array in the Granite State.

The $5 million 2-megawatt ground-mounted solar photovoltaic system includes 7,200 panels and 40 inverter. The system is expected to produce 3.3 million kilowatt hours of electricity per year.

Wheeler added that the co-op says the array will save members nearly $300,000 a year by reducing the amount of electricity the co-op buys on the wholesale market. It will also generate renewable energy credits to meet New Hampshire's Renewable Portfolio Standard and allow the co-op to explore battery-storage technology.

The project, which represents the co-op's initial foray into making energy, is financed through New Clean Energy Renewable Bonds from the U.S. Treasury Department.

"Although it will cover a small portion of our members' total electricity needs, one of the biggest benefits of this project is the price stability it offers," said NHEC President and CEO Steve Camerino, in a statement. "Wholesale power prices can vary widely," he continued, "but this project will provide NHEC's members a reliable source of renewable energy at a fixed cost, with a projected lifespan of a quarter century or longer,"

Camerino said the Moultonborough solar project builds on the co-op's experience operating two smaller solar photovoltaic systems at its district offices in Raymond and Sunapee, and may

Cont'd on p.33

Batteries: Lead-Acid vs. Lithium

"The times they are a-changin'" - Bob Dylan

By N. R. Mallery and George Harvey

Until recently, the choice for battery storage of renewable energy generation has mostly been with lead-acid options. Today, with all the new battery technologies touted as the greatest and the latest, many are asking, "What is the best battery for my application?"

In the past, if you wanted a battery backup system for on or off-grid storage, the answer was clearly lead-acid battery options. Today, however, battery technology is one of the most heavily researched subjects of science. Scientists constantly look for less expensive, lighter, and safer systems. It leaves many of us not knowing which way to turn.

Nevertheless, one of the interesting things about this is that old, reliable technologies often still have their places. Perhaps a much better question should be, "How can I tell what the best battery for my application is?"

John Hassell, of Be Green Solar, in Benton, New Hampshire, helped us out on this. "There are a lot of things you need to know about," he said, "but four are at the top of the list."

1. What is the battery capacity? This is expressed in amp-hours. By multiplying the number of amp-hours times the voltage, we can find the amount of energy the battery can store in watt-hours.

2. What is the discharge rate for the stated capacity? This is the rate of how fast the batteries can be discharged. This is important, because you need to know that the battery you have will support all the loads you want it to power.

3. What is the depth of discharge (DOD)? This tells what part of the total energy the battery holds can be used before it should be recharged.

4. What is the expected life of the battery, which is measured by cycles of charge and discharge? Also, what are the warranty terms?

Knowing the answers to these questions will not give you all the information you need to make decisions, but they are a good start. Other things to consider are often related to the place the battery system will be installed, and the attention it will require. They include the weight, physical size, operating temperature range, need to vent for generated gases, cost relative to capacity, need for maintenance, the ability to hold a charge when not in use, and more.

The biggest recent changes for home energy storage are due to new lithium battery technology. Most famously, Tesla has introduced its PowerWall 2 battery, which cut the price of lithium-ion batteries. Though they are great batteries for many circumstances, they are not perfect for all. They are not recommended for off-grid applications, for example. Part of the reason for this appears to be that the lithium-ion technology they use requires active cooling. Without cooling, temperature control becomes an issue and must be managed by the battery's BMS.

There are other outstanding lithium technologies available, however, without concerns of overheating. There are many to choose from, but we are most familiar with RELiON, SimpliPhi, Sonnen, and Iron Edison, which are all brands that we recommend. They all offer lithium-iron-phosphate batteries (called LiFePO4). These batteries are readily available and have some significant advantages for a home or business. They are safe, reliable, and not ecologically hazardous, and require a considerably smaller space than lead-acid options for the same amount of storage.

After much research, co-author N. R. Mallery is currently in the process of replacing her current bank of 24-2V lead-acid batteries for the third time since her system was built in 2002. The new bank will consist of just two to four lithium batteries. Their initial higher cost will be more than compensated for due to their 16 to 25 year lifespan alone. During that time, they will need no maintenance. Where most lead-acid batteries can only be discharged 50% without damage, the lithium batteries can be discharged to 70% to 80%, or even completely with some brands. Unlike lead-acid batteries, lithium batteries maintain a relatively flat voltage as

Cont'd on p.25

Before: System with lead-acid batteries in need of replacement.

After: The same system with new lithium batteries. Courtesy photos: John Hassell.

Tracking Solar in the Pioneer Valley

By George Harvey

Solar tracking system in a field of flowers. Photos by Stephanie Williams, Solar Store of Greenfield.

Many people who are interested in installing solar systems at their homes think in terms of an array mounted on the roof, or one mounted on the ground in a fixed position, pointing at the average position of the noonday sun. If they want to get the maximum value out of their solar panels, however, they might want to consider going beyond these two scenarios and think of a third alternative, solar trackers.

Tracking mounts are more expensive than fixed mounts, so they add to the overall cost of installation. On the other hand, they can be the more economical choice. They make far more efficient use of the investment into solar panels, because they produce considerably more electricity from the same amount of sunshine. They produce about 35% to 40% more electricity from the same number of solar panels.

Claire Chang and John Ward, who operate the Solar Store of Greenfield (SSG) in Greenfield, Massachusetts, have been installing tracking systems made by AllEarth Renewables in Williston, Vermont since 2014. Chang explained the advantage of tracking. "The production curve from a fixed array is a bell curve," Chang said. That is because a fixed system is only pointing directly at the sun at noon. By contrast, the tracking system points its panels directly at the sun as soon as the sun appears, and it keeps them pointing directly at the sun until the sun sets, so the change to and from maximum output is steep. Chang said, "The tracker's curve is a very broad peak through a sunny day. It is shaped like a sandwich bread loaf."

There is more to the tracker's motions than that, however. The mount has an anemometer to keep track of wind speed. When the winds get too strong, (upwards of 30 miles per hour), the array moves into a horizontal position. This not only prevents the wind from damaging the solar panels by not pulling and pushing on them, it also makes them much less vulnerable to being hit by wind-blown objects. The system is rated to withstand winds of up to 120 miles per hour.

Another issue for solar systems is snow loads. The AllEarth Renewable trackers automatically shed snow by pointing north and setting the panels at a steep angle.

SSG is not a big business, and it shares work with partners. The trackers are mounted on concrete bases, with preparation and installation done by Renaisance Excavating, in Gill, Massachusetts. SSG also partners with Torrico Electric in Sheffield, Massachusetts for electrical work. By doing this, SSG is able to focus specifically on getting to the best solar solutions for a given site.

Customers we have talked with are very pleased with their systems. Joseph Graveline had his system installed in the spring of 2015 and saw it come online in June. Asked about his experience, he said, "It is an amazing system. One thing that makes it is so amazing is that I never have to think about it." He clearly does enjoy thinking about it from time to time, however. When we talked with him he had just taken a look at its output. "It was 7,100 watts at 4:00 pm." That is not bad for a late afternoon in the winter, considering that the tracker with 24 panels, each of 300 watts, has a total rated capacity of 7,200 watts.

Stacy Bond, another customer, said, "We don't pay any electricity bill, which is fabulous." She also praised Claire Chang for her ability to answer questions clearly.

Chang was careful to point out that trackers cannot be installed just anywhere. A site evaluation is one of the first steps toward having a solar system installed. They may require special permitting in some communities and are subject to rules covering a range from zoning to wetland conservation. It is also necessary for the location to be shade-free from about 7:00 AM to 7:00 PM to take full advantage of the tracking systems. Even so, many locations are suitable for them, and Chang said about half of SSG's installations use them.

The website for Solar Store of Greenfield is http://solarstoreofgreenfield.com/. ♻

Tracker drive unit. Credit: Solar Store of Greenfield.

Northhampton and Amherst, MA Vote to Go 100% Renewable

By Green Energy Times Staff

Two Massachusetts communities, Northampton and Amherst, have voted to join the growing list of towns and cities committed to getting 100% of their energy from renewable sources.

The Northampton City Council voted unanimously to commit to a goal of 100% renewable energy for the community at a meeting on January 18th. The action was reaffirmed at a meeting on February 2nd. The resolution provided for developing a plan to achieve the goal, which would include the time-line for completion. To do that, the city will begin by studying the challenges and benefits of the action.

The resolution passed in Northampton was drafted with help from the environmental group, Clito mate Action Now. It had also been supported by the Mayor's Youth Commission and the city's Energy and Sustainability Commission.

Earlier, the town of Amherst had also voted to get 100% of the energy for the town's new and expanded buildings from renewable sources. The resolution had been brought before the town meeting, where it passed by a vote of 123 to 54 on November 8th. There had been a growing awareness in Amherst of buildings with low energy use because of the Kern Center and the Hitchcock Center for the Environment, both of which are in net-zero buildings, on the Hampshire College campus. At the same town meeting, voters adopted a resolution to take Amherst 100% renewable energy use by 2050.

Amherst and Northampton are by no means the only communities in Massachusetts that are committed to goals of 100% renewable energy. Cambridge, Framingham, Leverett, Lowell, Salem, and Wendell have done so by passing resolutions and warrant articles. Concord, Massachusetts has committed to getting 100% of its electricity from renewable power, and Hingham has committed to getting 100% from carbon-free sources.

The reasons to move to 100% renewable energy are numerous, and with the declining costs of renewable power, there are no reasons not to do so. A number of resource organizations have helped these communities make their commitments to clean energy. A toolkit to help is available from Mass Power Forward at http://bit.ly/roadto100percent.

Solar Power in NYS Exceeds 1,000% Growth

- **Since 2011, Solar Growth Leveraged $2.8 Billion in Private Investment, fueling 12,000 jobs Across the State**
- **Increased Capacity Supports Governor's Mandate for 50% of Energy Consumed to Come from Renewable Energy by 2030**

On February 6, Governor Andrew M. Cuomo announced that solar power in New York increased more than 1,000% from December 2011 to December 2017, leveraging more than $2.8 billion in private investment into New York's growing clean energy economy. Solar is critical to achieving the Governor's mandate for half of all electricity consumed to come from renewable energy sources by 2030 and cements New York as one of the national leaders in clean energy growth.

"Solar is a vital part of this state's clean energy future and we have experienced unprecedented growth in this new sector," Governor Cuomo said. "We will continue to support the development of solar, helping to spur economic growth, creating new jobs and helping to build a cleaner, greener and more sustainable New York for all."

The announcement was made by Lieutenant Governor Kathy Hochul at McKinley High School in Buffalo, where she also lauded what is currently the largest state-supported solar project in a school district in New York State. The nineteen solar installations at Buffalo public schools total nearly three megawatts. Projects are installed and operational at 18 locations with the one remaining solar project expected to be operational in the coming months. In total, the projects are anticipated to reduce greenhouse gas emissions by more than 1,700 metric tons annually, the equivalent to removing more than 370 cars from the road.

"Governor Cuomo has committed New York to lead by example in our pursuit of fighting climate change and achieving bold clean energy goals, and this 1,000% solar growth milestone is a significant marker of progress," Lieutenant Governor Kathy Hochul said. "I commend the Buffalo Public School System for recognizing the importance of reducing its carbon footprint and for combining education with operation, installing the largest state-supported solar project in New York schools and providing students with the opportunity for hands-on learning in the industry. Investing in solar is part of New York's strategy to boost renewable energy while creating jobs of the future."

The more than 1,000% solar growth in the state over the last six years was supported by the New York State Energy Research and Development Authority through the $1 billion NY-Sun program, the New York Power Authority, and Long Island Power Authority. 972.2 megawatts (78,323 solar projects) were installed through the end of December 2017, compared with 83 megawatts (8,989 projects) through the end of 2011. The current projects produce enough electricity that would be sufficient to meet the needs of more than 159,000 average homes.

Today's announcement also is another example of how solar is growing across the state into every community, supporting the Governor's 2018 State of the State proposal to expand more solar into communities for low income customers, advancing their participation in the growing clean energy economy and protecting their environments from the harmful effects of climate change.

Richard L. Kauffman, Chairman of Energy and Finance for New York said, "A 1000% growth in solar shows how viable and affordable clean energy technologies have become in the State for consumers and public and private entities. Under Governor Cuomo and our nation-leading clean energy initiatives, New York is leading the way in combating climate change bringing in substantial investment from the private sector which has fueled impressive solar growth over the past six years."

The significant growth of solar power is attributed to a combination of factors, including the NY-Sun Megawatt Block Incentive program and a decline in solar equipment prices and a growing solar installation industry.

Alicia Barton, NYSERDA President and CEO, said, "Today's remarkable milestone of 1000% solar growth demonstrates that, under Governor Cuomo's leadership, New York is rapidly marching towards our commitment to meet 50% of our statewide electricity needs with renewable energy by 2030. Solar energy is increasingly the first choice for consumers who want to reduce carbon emissions while lowering their energy bills and these projects are creating thousands of good quality jobs all across our state- it's a win for customers, communities, for the environment and our economy."

The largest percentage increase in solar power was in New York City, followed by the Mohawk Valley, Mid-Hudson, Central New York and the Capital Region.

The table highlights the significant expansion of solar power under NYSERDA in each region of the state from the end of 2011 through the end of December 2017.

Long Island now has approximately 420 megawatts of installed solar capacity, enough to power more than 70,000 average homes. Many of these projects received funding through the NY-Sun program or PSEG Long Island solar programs. Long Island is the first New York region to meet the State's megawatt block target for the residential market, underscoring the effectiveness and success of NY-Sun and the other Long Island utility programs. The residential momentum across Long Island is expected to continue because of federal and state tax credits, affordable financing for underserved communities, and an established market of solar developers.

In addition to the more than 1,000% increase of completed projects, there are 1,097 MW of solar projects currently under development statewide. If built, those installations would produce enough energy to power more than 186,000 average homes.

In that pipeline are 728 megawatts of community solar projects that will expand the market to residents who cannot put solar panels on their own homes. New York also receives on average 900 applications monthly for residential systems.

In 2014, Governor Cuomo made a historic commitment of nearly $1 billion to NY-Sun to stimulate the marketplace and increase the number of solar electric systems across the State over 10 years. NY-Sun aims to add a total of three gigawatts of installed solar capacity in the State by 2023. (One gigawatt equals 1,000 megawatts.) New York now has more than 12,000 workers engaged in solar jobs.

Read more at http://bit.ly/1000-percent-growth-solar-power-new-york. ♻

Growth in NYSERDA-Supported PV Deployed in New York State, December 31, 2011 - December 31, 2017

Region	Total Installed Through 2011		Total Installed Through December 2017		% MWs Increase	% Projects Increase
	MWs Installed	Projects Installed	MWs Installed	Projects Installed		
Capital Region	9.91	991	154.93	9,914	1463%	900%
Central New York	1.75	185	43.63	1,970	2393%	965%
Finger Lakes	2.36	266	56.06	2,257	2275%	748%
Long Island	38.26	4,756	237.10	26,077	520%	448%
Mid-Hudson	12.88	1,353	208.38	17,511	1518%	1194%
Mohawk Valley	1.59	162	41.51	2,211	2510%	1265%
New York City	7.35	404	127.43	12,326	1634%	2951%
North Country	1.51	200	17.99	1,250	1092%	525%
Southern Tier	2.28	402	34.12	2,348	1396%	484%
Western New York	5.18	360	51.13	2,459	887%	583%
Total	83.06	9,079	972.27	78,323	1071%	763%

Notes: Includes only NYSERDA-supported projects. Pipeline projects not included.

Plummeting Cost of Solar Plus Storage

By George Harvey

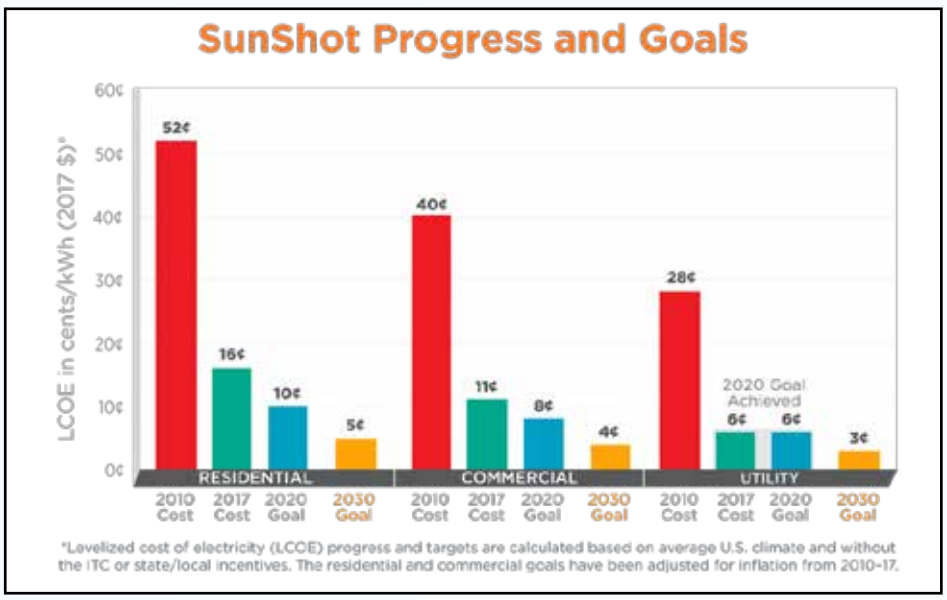
Watching the progress of a no-hitter in baseball has an unusual aspect to it. The exciting thing is that nothing new happens. The moment the game changes, the excitement ends.

That is how it has been with the prices of electricity from renewable power. The costs of solar and wind power have just kept going down. And since they have just kept doing that, we could see that sooner or later, a situation called "grid parity," the point at which further investment in fossil fuels becomes increasingly uneconomical, would be achieved.

Now, the whole game for renewable energy is changing. But unlike the no-hitter, where a hit could spoil the excitement, it has become even more exciting. The prices bid for electricity from solar photovoltaics (PVs), wind power, and batteries have not hit record lows that could have been predicted. They have hit new lows at levels few people imagined only months ago.

Xcel Energy operates four utilities in eight states, mostly in the Midwest. Last year, it decided to close down some coal-fired generating plants, and put out bids for capacity to replace them.

The amount of power to be bid on was huge. They asked for proposals on 238 projects, with a total of over 58 gigawatts, to be completed within five years. Of the total in the bids, less than 6% was to be powered by fossil fuels. Stand-alone battery storage accounted for 3.3%. Nearly all of the rest consisted of various combinations of PVs, wind power, and batteries.



As shocking as the size of the solicitation was, it was the bids themselves that were most impressive. The bids for wind, solar, and batteries were astonishingly low.

We should review the numbers from Lazard Associates to put the new numbers into context. The most recent were published last November and can be found at http://bit.ly/LCOE-11. They report levelized costs of electricity, meaning that the costs of subsidies and tax breaks are included to make overall costs comparable, and the prices they cite are for the wholesale market.

I have translated them here to prices in cents per kilowatt-hour (¢/kWh), because that is what most people are used to. They put the cost of utility-scale solar power in 2017 in the range of 4.3¢/kWh to 5.3¢/kWh. With battery backup, solar is put at 8.2/¢/kWh. Wind power is at 3¢/kWh to 6¢/kWh. By contrast, the least expensive fossil fuel, combined cycle natural gas, is in a range from 4.2¢/kWh to 7.8¢/kWh.

The bids for the Xcel solicitation are far lower. For the median bids, meaning that half of the bids were at or above the figure, and half were at it or lower, the cost for wind power was 1.81¢/kWh. For wind power with battery backup, the median cost was 2.1¢/kWh.

This means that half the bids for wind power, with batteries, were below a price that was only half the lowest cost for the least expensive fossil fuel. A list of other prices is available in the article, "This is How Wind and Solar Energy will Crush Fossil Fuels," at the investment site, Motley Fool. It can be found at http://bit.ly/crushing-fossil-fuels.

There are many caveats about these numbers. The Xcel bids were not levelized, and so are not directly comparable to those at Lazard, though we should note that the incentives and tax credits will run out well before 2022, so we can assume that they have no effects on the bids. The people making the bids are doing so based on estimates of how the prices will change. We do not know what effects will be from the tariffs President Trump ordered on solar panels, and there are other contingencies we cannot judge.

Nevertheless, it is clear that times are changing rapidly. We are entering a time fossil fuels are no longer competitive with renewables. They are not even in the same ballpark. ♻

Tidal Power

By Joan Rech

The 16-metres-in-diameter turbine is lowered into place from a platform designed by Open-Hydro. Image: Cape Sharp Tidal.

Canada's Bay of Fundy has extreme tides - which may be an understatement. At the east end of the bay near Truro (Nova Scotia), the vertical difference between high and low tide exceeds 16 metres (54 feet). Currently 50% of Nova Scotia's electricity is generated from burning coal. The province has committed to obtaining 40% from renewable sources by 2020. Can the bay's powerful tides be one such source?

To understand the present, it is necessary to review past activity on the Bay of Fundy, specifically on the Annapolis River. The area was settled by Europeans – French – in the 17th Century. Based on their experience in Europe, they recognized the agricultural potential of the marshlands around the river and built dykes to drain the marshes. The dykes were earthen and sod berms with basic wooden sluiceways with a one-way valve or flap at the end. The flap allowed fresh water to drain but prevented salt water from flowing in. Within two to three years, the salt water had been flushed from the marshes leaving very fertile and productive farmland.

Fast forward to the 1950's. The province was responsible for maintaining the dykes. The Maritime Marshlands Reclamation Authority, rather than maintain the network of dykes, built a dam and a set of sluice gates to regulate the incoming tide. The dam transformed a productive tidal wetland into a freshwater lake. Salt water species died off. Without spartina grass to hold the banks in place, erosion from strong west winds increased dramatically. It was, in the words of one area resident, an environmental disaster.

The energy crisis in the 1970's led to the idea of a mega-project: a dam in the upper part of the Bay of Fundy which might meet most of the electrical needs of the province. Since no turbine yet existed to meet the requirements of the site, a prototype was built and installed in the existing dam on the Annapolis River. This turbine, built by Esher/Wyss, is able to resist corrosion by saltwater and damage from sediment. It is controlled by a computer which varies the strength of the electromagnet with the varying pressure of the water as the tides rise and fall. The level of the water is controlled by the sluice gates. When the incoming tide reaches the level of the lake, the gates are opened. After the lake rises approximately 0.8 metre, the gates are closed. When the tide falls below the lake level, the water is directed through the turbine, generating electricity. It operates in one direction only, when the tide is flowing out. It runs approximately five hours during a 12 hour, 25 minute tide cycle, and at its peak, it generates a maximum of 20 megawatts.

The Annapolis Tidal Generating Station has been operating since 1984. To be clear, it is a tidal-hydro station. Electricity is generated not from the energy of the tides but from the difference in level between the lake behind the dam and the estuary in front of the dam. It is the only one of its kind in North America, and it likely will be the only one of its kind. It was built only because the dam already existed.

In 2007, Nova Scotia's Department of Energy initiated a process to look at the tides themselves as a potential source of energy. Determined not to repeat the mistakes of the past, community outreach and participation were part of the process from its inception. A panel of stakeholders (including area residents and businesses, municipal governments, fishermen, representatives of the Mi'kmaq community) were assembled to develop guidelines. The panel agreed on three principles:

Nothing will be installed that cannot be removed (i.e., NO MORE DAMS).

Installation will be done incrementally.

The effects on currents, sedimentation and marine life will be thoroughly monitored.

This led to the creation of the Fundy Ocean Research Centre for Energy (FORCE), a test center for in-stream tidal in the Minas Passage, a channel 5.5 km. wide between the main bay and the Minas Basin. It was chosen because there are strong currents at depths between 30 and 55 metres, and because it is an area of relatively low biodiversity. The sea floor is bedrock; fish use the passage but do not spawn there. As a non-profit organization, FORCE is authorized by Nova Scotia Environment to lease berths (essentially study areas) for research projects. The first turbine was lowered into place to record data in November, 2009. Post-recovery examination revealed that it had failed. The fins had been damaged by Fundy's strong current. OpenHydro, the Irish tidal power technology company that built the turbine, was undeterred. There was, they pointed out, more energy there than had been anticipated, and they proceeded to reengineer the turbine.

Cape Sharp Tidal, a joint venture between Emera, the parent company of Nova Scotia Power, and OpenHydro, is a lessee. They aim to determine whether grid-connect in-stream turbines can produce energy silently, invisibly, and without harm to the environment. The first of two grid-connected 2 megawatt turbines was deployed in November, 2016. It is an open centre turbine which rotates on a horizontal axis. It has permanent magnets embedded in its outer rim, which rotate past the generator coils, which are housed within the duct. It is approximately 16 metres in diameter. A large triangular base brings the total weight of the unit to approximately 1,000 tonnes, and its weight holds the device securely to the bottom of the channel. Electrical control modules convert the output of the device to alternating current in synchronization with the grid, and underwater transmission cables deliver the power to a substation on shore.

The turbine is lowered into place from an OpenHydro-designed barge and deployment/recovery platform which allows for micro-siting within the berth area. It operates at a slow speed, 6 to 8 rotations per minute. Because of the slow speed, there are no pressure changes in its vicinity. In addition, it uses no oil, so there is no potential for spills or contamination. The turbine operates continuously, both when the tide is flowing in and flowing out.

The turbine has a projected life span of 15 years with maintenance scheduled every 5 years. It is estimated that the two 2-megawatt turbines will replace the consumption of 2,000 tonnes of coal annually, the burning of which would result in 6,000 tonnes of greenhouse gases.

The turbine was retrieved in June 2017 for minor repairs and upgrades which are still in progress. A second 2-megawatt turbine is scheduled for deployment in the spring of 2018.

For more information on the project (including detailed information on environmental monitoring), go to www.capesharptidal.com. For more information on the Annapolis Tidal Generating Station, visit http://bit.ly/Annapolis-TidalStation. The Annapolis Tidal Generating Station Interpretive Centre is on Route 1 east of Annapolis Royal. It is open mid-May through mid-October.

My thanks to Les Smith, Manager of Interpretive Services at the Centre, who provided information for this article.

Joan Rech is part of the New York G.E.T. distribution team and enjoys visiting Canada. ♻

No Grid - No Problem!

Cont'd from p.10

medicines for neighbors that needed them kept refrigerated. Some folks came by to charge up their cell phones. Some other neighbors have generators, but it's nice to not contribute to the noise and smell of those!

Tom and Mary didn't even see the lights blink during an outage at their home in Maine.

FAQs About Solar & Battery Backup

With a good 1/3 of northern New England's electric grid knocked out for multiple days in October 2017, there has been a huge uptick in interest in solar battery backup. Some of the common questions people have are:

How much of my home can a battery backup array power?

In short, it really depends on your goal and budget. For every battery system we build, we'll work with the customer to discuss their critical backup loads, and how long they want to design the system to power their home without any solar recharge, etc.

In most situations, we design the backup system to power a critical subset of the home's energy needs for 1-2 days with no sun. With sunshine available, a battery can keep you going indefinitely! This includes things like running a refrigerator, well pump, boiler, limited lighting, and re-charging electronics (cell phones and laptop computers need relatively little power).

If I have grid-only solar now, can I add battery backup?

Absolutely! There are a number of options, including the popular Tesla Powerwall.

These battery systems integrate on the alternating current (AC) side, so they are compatible with any grid-tied solar inverter, and operate at extremely high electrical efficiencies, so you don't have to worry about 'round trip' loss as the energy converts from sunshine, to usable AC energy power, to stored battery power, and back again.

Should I get a home battery backup system or a standby generator?

Solar battery backup compares favorably with the total ownership costs of a home standby generator. Check out this chart comparing solar-powered battery vs. generator at http://bit.ly/solar-battery-vs-generator.

Revised from ReVision Energy News, Under the Sun from 11.11.17. Original title was "Pika Energy Island Keeps the Power On." ♻

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

• ***Note that these incentives end on Dec. 1, 2017! Reservations by 12/1/17 have 6 mos. to be installed.***

• $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.*

Advanced Wood Heating

• Advanced wood pellet heating systems -- $3000 per boiler/furnace

• Custom Rebate $1.25/ft2 of heated space, $25,000 max ($20,000 max for heating system and $5,000 additional incentive if system includes thermal storage, $10/kBtu thermal capacity).

• **Details at www.RERC-vt.org or call (877)888-7372**

VT TAX CREDITS

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

Tier III programs

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

EFFICIENCY VERMONT

Lighting (must be ENERGY STAR®)

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

Home Efficiency Improvements

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

Appliances (must be ENERGY STAR)

• Dehumidifiers $25 - $40 mail-in rebate

• Clothes Washers - $40 - $75 rebate

• Refrigerators - $40 - $75 rebate

• Clothes Dryers - $50 to $400 rebate

Heating/Cooling

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

• Select smart thermostats - up to $100 rebate

• Solar water heaters - $950 rebate post installation

• Heat pump water heaters - $300-$500 rebate or point of purchase discount

• Central wood pellet boilers (excluding outside wood systems) - $3,000 rebate

• Circulator pumps - $15-$50 point of purchase discount

• Cold climate heat pumps $600-$800 point of purchase discount

Residential New Construction

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

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

Other Opportunities To Save

• Advanced Power Strips – special pricing starting at $6.95*

• Pool Pumps – up to $600 rebate on select ENERGY STAR models

• Commercial Refrigeration Evaporator Fan Motors - $60-$100 each w/ point of purchase discount

• Heat Saver Loan – low-interest loans of up to $35,000 for home weatherization and heating improvements

• For commercial refrigeration, lighting, or HVAC rebates, apply online for a 20% bonus at rebates.efficiencyvermont.com

*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

• 0.65/watt (lower of AC and DC) for new solar electric facilities

• Expansions to existing solar systems are not eligible.

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

• $0.12/rated or modeled kBtu/year for new solar thermal facilities fifteen collectors in size or fewer;

• $0.07/rated or modeled kBtu/year for new solar thermal facilities greater than fifteen collectors in size; and

• Expansions to existing solar systems are not eligible.

Category 2:

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

• $0.55/Watt AC for new electric facilities.

• Expansions to existing solar systems are not eligible.

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

Note: Category 2 may have a waitlist.

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

PACE

The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes.
Visit http://cpace-nh.com/index.html for more information.

Residential Renewable Electric Rebate Program.

$0.20/watt up to $1,000 or 30% of system costs, whichever is lower, effective Jan. 2, 2018. Available on a first come basis as funding is available, after processing lottery applications received prior to February 1, 2018. http://bit.ly/NHResidentalRebate

Contact karen.cramton@puc.nh.gov

Residential Solar Water Heating Rebate Program

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

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

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

Systems must be 2.5 million BTU or less

Residential Wood Pellet Boiler/Furnace

• 40% of installed system up to $10k

• Must meet thermal efficiency and particulate emissions standards

Contact barbara.bernstein@puc.nh.gov

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

LOCAL INCENTIVES

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

• These are offered on a town-by-town basis.

• The state also has passed PACE (property-assessed clean energy) enabling legislation which will allow towns to use the PACE mechanism to finance clean energy projects through property taxes

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

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

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

• NHEC offers incentives on Electric Vehicle Supply Equipment (EVSE) of up to $2,500 (only Commercial and Municipal members are eligible for incentives)

• Pre-approval is required.

• Visit: https://www.nhec.com/

NH Home Performance with ENERGY STAR

Sponsored by all NH electric and natural gas utilities in partnership by the U.S. Dept. of Energy. Fuel-blind eligibility using the Home Heating Index (BTUs of heating fuel / conditioned square feet / heating degree days). Must provide at least 12 months of heating fuel history. Once qualified, eligible homes get a $450 value compre

hensive energy audit for $100 (rebated if improvements installed), and 50% instant rebate for eligible weatherization improvements up to a $4,000.

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

NH ENERGY STAR Homes

• Incentives for new homes which meet ENERGY STAR guidelines. Incentives include

• HERS rating fees paid by the utility, rebates for ENERGY STAR lighting, appliances –up to $4,000 based on the HERS score.

• Visit www.NHSaves.com/newhome for more details.

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.

NHSaves Residential ENERGY STAR ® certified Products Program

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

• Refrigerator/freezer recycling is available – unit must be in working condition (10 – 30 cubic feet in size), program includes free pickup and $30 rebate. For program requirements and scheduling information go to www.NHSaves.com/recycle.

• Instant rebates available on certain ENERGY STAR® certified LED light bulbs purchased through participating NH retailers, and instant or mail-in rebates available on ENERGY STAR® certified light fixtures (varies by retailer, see store associate or rebate form for details). For more information please visit www.NHSaves.com/lighting.

• Rebates are available only to residential electric customers of the four NHSaves utilities.s

NHSAVES Online Store

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

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

PAREI

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

• www.nhsaves.com

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

• Rebates of up to $500/ton on Air Source and Geothermal Heat Pumps. Rebates of $500 - $600 on Heat Pump Water Heaters. Rebates of $100 on WiFi Thermostats

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

Other NH Electric Utility Programs

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

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

Business Programs

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

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

NH Weatherization Assistance Income-Eligible Programs

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

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

MASSACHUSETTS

Commonwealth Solar Hot Water (SHW) Programs

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

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

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

MassSave Heat Loan SHW

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

Energy Efficiency

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

Mass. Solar loan Program

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

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

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

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

DEPT OF ENERGY RESOURCES

• The Massachusetts DOER is in the process of designing a new solar incentive program. The latest information can be found at http://bit.ly/SMART-Solar-Incentives-Program.

• Solar renewable-energy credits (SRECs) associated with system generation belong to the system owner and may be sold via the Department of Energy Resources (DOER) SREC 2 program. Systems sized under 10kW single phase or 25kW three phase have an extension until the new incentive program starts in 2017. Note: appropriate, approved Data Acquisition System monitoring must be utilized for PV systems >10kW in order to qualify to sell SRECs.

• Next solar incentive information can be found at http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/development-of-the-next-solar-incentive.html

• MA State Income tax credit for residential solar hot water or PV systems are eligible for a one-time 15% off system cost, capped at $1000 max tax credit.

• No sales tax on residential solar hot water or PV system.

• There is no increase in property tax assessment for residential solar hot water or PV systems for 20 yrs.

MA SREC II Policy

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

• The credits provided for energy produced by a system are calculated b 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 brownfield site, or if it is less than 650 kW, then it gets a factor of 0.8. Systems that qualify for none of the foregoing get a factor of 0.7.

- Expect changes in spring 2018.

• http://bit.ly/Mass_SREC_II.

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

Woodstove Change-out Program

• The Commonwealth Woodstove Change-Out program, a partnership between MassCEC, the Massachusetts Department of Environmental Protection and the Department of Energy Resources, offers rebates to assist Massachusetts residents in replacing non-EPA-certified wood stoves with cleaner, more efficient EPA-certified wood or pellet stoves.

• Standard rebates range from $500 to $1,750 per change-out, and low-income rebates range from $1,500 to $3,000, based on stove specifications

• http://www.masscec.com/get-clean-energy/residential/commonwealth-woodstove-changeout?utm_source=Woodstove%20Change-Out%20Announcement&utm_campaign=Woodstove%20&utm_medium=email

Electric Vehicles

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

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

NEW YORK

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH nyserda

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

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

New York State Energy Research and Development Authority.

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

Home Energy Waste

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

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

RENEWABLE ENERGY INCENTIVES OFFERED THROUGH NY-SUN

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

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

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

• https://www.powerclerk.com/nysuniniitiative/dashboard.aspx

Residential and Small Business

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

Commercial and Industrial

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

Community Solar

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

Commercial/Industrial PV Installer

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

Residential/Small Commercial Solar PV Installer

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

Financing Options

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

Clean Power Estimator

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

Geothermal

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

Electric car

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

Utility sponsored incentives & tips:

http://bit.ly/utility_sponsored_incentives

Eversource Energy
Recognized Among Nation's Most Green Companies

By Chris Gillespie **PLUS: THE LATEST ON EVERSOURCE'S MAJOR CLEAN ENERGY PORTFOLIO PROJECTS**

An off-shore wind farm is proposed for 25 miles off the coast of New Bedford, MA to provide stable power for 500,000 homes, with the 55 MW of battery storage. Image: baystatewind.org

Eversource Energy, operator of New England's largest energy delivery system, has been recognized for its leadership in corporate sustainability and environmental performance by Newsweek's annual Green Rankings list. According to Newsweek, the Fortune 500 energy provider ranks 20th among 500 U.S. companies and fourth among U.S. utility companies. Although Eversource has historically performed well in the annual survey, this is its highest ranking to date.

"It's very rewarding to see our commitment to environmental sustainability be recognized in this way," said Eversource Chairman, President and CEO Jim Judge in a recent press release. "With the support of our employees, we will continue to build on the #1 ranking of our energy efficiency programs, grow our clean energy portfolio and partner with our customers and communities as stewards for our environment."

New additions to Eversource's clean energy portfolio include Bay State Wind, a recent partnership with Ørsted, the world's largest and most successful developer of offshore wind generation. On December 20, 2017, Bay State Wind submitted its bid to build Massachusetts' first offshore wind farm. If Bay State Wind succeeds, the subsequent wind farm would be the first large-scale offshore wind farm in North America.

According to the proposal, the wind farm will be 25 miles off the coast of New Bedford, MA and provide 500,000 homes in Massachusetts with clean, reliable, stable-priced power. The proposal also states that the wind farm will deliver $300 million in savings per year in lower winter power costs. In order to ensure that power is available during peak-demand hours, the proposed New Bedford project will include a 55 MW battery storage solution, the largest battery storage system ever deployed in conjunction with a wind farm.

"By capturing New England's powerful and consistent offshore wind resource through the most advanced generation and transmission technology, we can provide clean electricity directly to the region," said Eversource Vice President of Business Development Mike Auseré regarding the proposal. "Additionally, Massachusetts will see major new investment, job creation, and an increase in tax revenues to support public services."

Another key component of Eversource's clean energy portfolio is the controversial Northern Pass Transmission, a partnership between Eversource and Canada's Hydro-Québec. Through Northern Pass, Eversource and Hydro-Québec hope to bring hydropower generated in Canada down into the New England power grid. To do this, Northern Pass would construct a 192-mile transmission line, spanning nearly the entire length of New Hampshire, from Pittsburg in the north to Deerfield near the south.

Supporters of Northern Pass believe the project will spur economic development in the Granite State, while also providing enough clean energy to power roughly a million homes. Opponents of the plan cite environmental concerns and worries that the towers carrying the powerlines will significantly detract from northern New Hampshire's world-famous scenery and hurt surrounding ecosystems.

On January 25, Massachusetts approved Eversource's Northern Pass proposal. On February 1, the New Hampshire Site Evaluation Committee, the final entity needed to approve the project, voted unanimously against granting Eversource a permit for the project. Eversource intends to appeal the decision, putting Northern Pass's immediate future in limbo for both Massachusetts and New Hampshire.

Regardless of what ultimately happens with Northern Pass, it is likely that Eversource will continue to work to maintain its role as a green leader for utility and non-utility companies alike.

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

[Editor's note: Northern Pass was one of several projects proposed to fill the needs of Massachusetts to get power from Canada. Though it has been denied approval in New Hampshire, the other projects are still viable, and Massachusetts has other options to get the renewable power it was seeking.]

Concerned Citizens Left Bewildered About Solar Issues in Massachusetts

On January 5, 2018, Massachusetts Department of Public Utilities' (DPU) decided to raise rates, creating uncertainty for future solar customers in the Eversource utility territory. Under the Eversource proposal approved by the Commission, solar customers in the state's largest utility service area will be forced onto demand charges. These unpredictable charges are determined by a customer's highest electricity usage over an entire monthly billing period. Vote Solar is challenging this order and, in early February, submitted a petition of appeal filed in the Massachusetts Supreme Judicial Court. Learn more at http://bit.ly/Vote-Solar-Eversource-Rate_Hike.

This decision seems to be counterintuitive to the role that Eversource has been recognized for as a green leader. It has left some concerned people in the area bewildered about this decision. ♻

Green Mountain Power Doubles its Carbon Reduction Goals in 2018

GMP and Customers Exceed 2017 Carbon Reduction Goals

Green Mountain Power (GMP) has set an ambitious goal for carbon reduction in 2018 and beyond. The goal is to partner with Vermont customers to drive down costs and eliminate more than 8,000 metric tons of carbon emissions per year using clean energy for the next two decades. This will result in eliminating more than 160,000 metric tons of carbon emissions and, combined with past reductions, is the equivalent of removing nearly 3,000 cars from our roads each year for the next 20 years.

"This kind of meaningful change is possible because there are ways to deliver lower cost and lower carbon energy solutions and GMP residential and business customers are actively engaged and committed to action," says Mary Powell, president and CEO of GMP. "We know our customers value our efforts to reduce the state's carbon footprint, because they've proven it in the past. In 2017, for example, our target for carbon reduction was 3,000 metric tons and we actually eliminated 4,500 metric tons, the equivalent of removing about 1,000 cars from the road for the next 20 years. We thank our customers for their efforts to do that."

GMP and other energy companies in the state are hard at work identifying and bringing to market renewable, clean alternatives to fossil fuel. At the same time, GMP is partnering with customers to help them reduce their energy use by offering rebates, low-cost loans and other incentives. GMP's programs include:

- Residential programs that provide heat pumps, heat pump hot water heaters, battery storage and smart thermostats to Vermont homeowners at low cost or with favorable financing,
- Transportation programs that provide customers with in-home fast electric vehicle chargers and discounts on electric vehicles themselves,
- Customized projects that help commercial and industrial customers reduce their use of fossil fuels.

Powell related that many residential customers have taken advantage of GMP programs to bring leading-edge clean energy solutions to homes.

"More and more Vermonters are adopting solar energy solutions, battery storage, heat pumps and smart home devices each year," she noted. "At GMP, our focus is to put these tools within the reach of more people. Through these innovations we can transform our energy use and drive down costs."

She remarks that businesses, because of their scale and larger energy needs, can make an even bigger difference to the carbon bottom line.

"Energy innovation happens when you have the type of engaged energy community we have here, and we are thrilled that our Inspire Space has also attracted new energy entrepreneurs to Vermont who are working to transform options for customers. On the economics, we are finding solutions that can transform business practices and result in reduced energy use and cleaner methods," Powell explained. "This change often results in savings for business customers, but that's not the only reason they partner with us—or even the main one. Organizations in Vermont are committed to our environment and very proud of our state's reputation as a leader in energy innovation."

Just one organization that benefitted from GMP's customer innovations was the Farm & Wilderness collection of summer camps.

"We operate a number of buildings in different locations year-round at Farm & Wilderness," says Jay Kullman, sustainable resources director at Farm & Wilderness. "With the help of GMP, we installed Sensibo devices that allow us to monitor buildings when not in use, enabling us to reduce energy consumption even further with the heat pumps by keeping the temperature lower. When we plan on using one of our buildings, we simply use our smartphones to warm it in advance, and we no longer have to drive to the buildings to check on them during the winter," he adds.

GMP customers who are interested in learning more about how a home or business could reduce its carbon footprint should reach out to Green Mountain Power at 888-835-4672 or contact Jeff Monder at 802-770-3392 or jeff.monder@greenmountainpower.com. ♻

The BUSINESS CASE FOR SOLAR POWER

Cont'd from p.1

climate disaster unfolds before us.

While appreciation of neighbors is nice, and climate change must be addressed by all of us, from a practical point of view, many business people feel compelled to justify any expense in systems that will address the problems. And this is a group Jim Merriam was particularly addressing with his statements. Stable energy prices have real value, especially because the costs of fossil fuels fluctuate so much. You can only take a business plan to a bank if you know what your expenses will be, and you can only know what your energy expenses will be if they provide better stability than fossil fuels do. Tax reductions are easily evaluated, because they have monetary values. Increased property values can be more difficult to assess with any precision, but they are clearly advantageous.

The list above presents only four benefits of going to solar power, but it is a good starting point for a discussion of the business advantages of installing a solar power system. Other advantages worth mentioning include availability of special financing, power purchase agreements, renewable tax credits and other incentives, virtual net metering, shared solar options, and even special utility programs.

No business operates in a vacuum, and what is good for a local economy is usually good for the businesses within it. For sustainable development goals to be met by our society, businesses must develop and achieve their own goals. Solar power is quite consistently good for the local economy, and it is an important tool for almost any business, both for the sake of the general economy and for its own welfare. For most business owners trying to do right by their community, watching a solar installation personalizes how their choice supports rebuilding the trades and providing careers to our younger employees.

A 134-kw rooftop solar array for the DHMC Heater Road facility went online in Nov. 2017. Images: Norwich Solar Techologies

The issue of jobs serves as an example. High-quality employees will migrate quickly out of an area if there are no good prospects for employment, and where jobs can easily be outsourced to some other part of the planet. We can be sure that solar installers will not be outsourced in that way. Both climate change and economic pressures produce a sense of urgency for installing solar systems, so the jobs are unlikely to disappear. At the same time, a robust local economy can give local businesses a better employee pool and support.

Not only do physical realities and economics suggest job security, but they also imply that money in the local economies is more likely to stay in local economies with passing time, and that increases overall prosperity, a benefit for nearly any business.

Laws can be problematical, of course. State and local laws seem to change almost continuously. We at Green Energy Times sometimes feel hard pressed to keep up to report them every other month. A good solar installer must do this continually and provide relevant data as part of any site evaluation. This includes everything from tax incentives to the availability of net metering. Most business people are not at all prepared to evaluate the potential for solar power on their businesses, which makes Jim Merriam's assertion that he can help any business save money all the more important.

One thing we asked Merriam about was the potential effects of punitive tariffs on solar systems. He said that Norwich Technology was disappointed that the president had chosen to put a 30% tariff on imported solar panels. But he pointed to the benefits of solar power once more, stressing that they were still clear. "Because the benefits of solar are so overwhelmingly positive and obvious, we expect the tax to cause only a temporary setback in our pursuit of clean, local, inexpensive solar energy."

Pirouette Farm in Norwich, VT installed a 60.3kW roof-mount solar array in July 2016. This net-metered system offsets the farms energy loads and provides community solar in Norwich.

We discussed the actual numbers associated with the tariff. Merriam pointed out that the solar panels represent a higher percentage of the overall cost of the system as their sizes increase. This means that the tariff will have its greatest effect on utility-scale systems, and its least effect on those installed at households and small businesses. In a small system, the panels might represent only 25% of the total cost. Increasing the cost of the panels by 30% might only increase the cost of such a system by 7.5% or less, and that impact is less important as electric rates increase. By contrast, utility-scale solar systems have about 40% of their costs in the solar panels. This would mean that their overall costs might increase by about 10-12%. Please notice the word "might."

The costs of solar systems have been dropping so dramatically that for all systems, large and small, the cost increases from the tariffs are likely to have less effect than the falling costs. Last September, the National Renewable Energy Laboratory reported that in the previous year, the cost of installed utility-scale solar had fallen by 30%, an amount much greater than the projected 12% increase in cost from the tariffs. And commercial costs for solar power had fallen by 15%, a reduction that would still be greater than the increased costs.

The business case for solar power has been, and remains, very real. ♻

Colonial House Inn in Weston, VT provides skiers with a sustainable lodging option. The 30kW ground-mounted array was commissioned in October 2017.

Latest Job Census Shows Effects of Regulatory Actions on Vermont Trade Jobs

The new National Solar Jobs Census show a loss of 232 full-time jobs in the state's workforce after a 2017 marked by a volatile regulatory environment.

"More than 1,500 families are supported by a full-time Vermont solar job. Local solar workers help Vermonters cut their energy bills, do their part on climate, and help their neighbors access renewable energy," said Olivia Campbell Andersen, Executive Director of Renewable Energy Vermont. "These local, small businesses are helping build stronger communities now. Given plenty of volatility out of Washington, we need to make sure Vermont's policies keep us on track towards our climate and clean energy commitments."

Nationally, the solar trades saw a 4% slow-down which experts attribute to, among a variety of factors, general uncertainty caused the Trump administration's solar tariff, which first started to rattle the national market for panels early last summer. Vermont's job loss is over three times the national average, at 13%, indicating that something more than national politics is affecting the sector.

Unfortunately, the news of both the decrease in installed solar capacity and loss of jobs does not come as news to solar installers who warned of these consequences during the reconfiguration of net metering rules in 2016. Net metering is a program which allows average Vermonters to generate their own electricity and sell excess clean electricity to the grid to for their neighbors to use. Recent analysis of solar data collected by the Vermont Public Utilities Commission showed regulatory changes on the popular net metering program resulted in a sharp decline in new

Cont'd on p.35

SUSTAINABLE WOODSTOCK, VERMONT

By George Harvey

Aerial view of Billings Farm and Museum

Image courtesy of Billings Farm and Museum

Late last spring, we got word that Phil Swanson, the Municipal Manager of Woodstock, Vermont, had signed a pledge making the town part of the Mayors for 100% Clean Energy movement. Our investigations into what was behind this turned out to be full of stories about delighful projects pursued by people who are outstanding in their respect for each other, the community, and the planet.

Ron Miller, who is active in Sustainable Woodstock, told us, "The Marsh-Billings-Rockefeller Mansion, part of the National Park System, is all about conservation. Woodstock has three generations of some of the leading conservationists in the United States, who gave it a heritage of conservation." Sustainability is a tradition in the town, and it goes back to the middle of the nineteenth century.

Barbara Barry, one of Sustainable Woodstock's founding board members, explained, "George Perkins Marsh is called the Father of Conservation. He wrote Man and Nature, book on conservation published in 1864." Wikipedia's entry on the book has this quote: "[He] warned that man could destroy himself and the Earth if we don't restore and sustain global resources and raise awareness about our actions."

Marsh's house in Woodstock was later the property of Frederick Billings, who established a managed forest and a progressive dairy farm in the 1870s. His grand-daughter, Mary Billings Rockefeller, and her husband Laurence Rockefeller, donated the property to the people of the United States in 1992.

There are so many things going on in Woodstock, it is hard to begin describing them. We might start by saying the efforts are largely divided between the people, especially those associated with Sustainable Woodstock, and the town government, which represents them with its own support for the cause.

THE TOWN OF WOODSTOCK

Woodstock is an example of a community that is doing just about everything it can to reduce its energy consumption and make sure that as much as possible of what it consumes is generated sustainably from renewable resources. It was able to lead on these matters because of the close cooperation of a fairly large number of citizens, including those who are most heavily involved in the town government.

The Select Board of Woodstock has taken a leading position in the movement to sustainability. Jill Davies, who is a board member, made it clear that the board's work has been focused on what it can do with town property to reduce waste and carbon emissions, increase efficiency, decrease costs, and provide its own power.

When Phil Swanson, the Municipal Manager, signed onto "Mayors for 100% Clean Energy," establishing a goal of powering Woodstock entirely with clean and renewable energy, he had the support of both the select board and the citizens who elected it. This is an impressive goal, committing the town to real goals.

A current project for the town is to have a solar array installed. This is being done by Norwich Solar Technologies. The 480-kW DC system will cover about 85% of the municipal electric consumption, including waste water treatment, the town garage, the fire department, the EMS, and the town hall. The project is fully financed, and reduces the town's expenses by amounts increasing each year from a start of about $13,000. It is believed that the town will save $550,000 over the course of the 25 year contract term.

In another project, Efficiency Vermont gave the town some deep energy retrofit grants. The town expects to save 40-50% of energy usage for the town hall, as a result of Insulation, window inserts, a new smaller boiler, and other improvement.

SUSTAINABLE WOODSTOCK

Bill Sullivan in front of solar panels installed during a solarize initiative

Aside from the municipal government, it seems that nearly all of the organized sustainability efforts of Woodstock has something to do with Sustainable Woodstock, an incorporated non-profit organization. Jill Davies explained the appeal and success of this organization, sayiang, "Woodstock is a small town, and when we get active, we organize to get things done."

Zach Ralph, who has been active in Sustainable Woodstock in a number of ways, commented, "The most important part in Woodstock was getting the commitment from the manager and select board."

The praise for each other extends to outside organizations, as well. Davies spoke of Efficiency Vermont, saying "Its great working with efficiency vermont because you can update everything and save money on your electricity bills, and they give you a grant to do it." She added, "They make it easy."

One of the things that is impressive about Woodstock is the sheer number of people involved in issues of sustainability and resilience. Ron Miller, the acting Chair of Sustainable Woodstock, told us something that might be a key to cooperation. "We avoid controvercial or political topics," he said. "We are not trying to beat people over the head about climate change or what is needed to change the political system. We get support from people who would not stand out as active environmentalists. We don't advocate that everything has to be solved by government money. Some of us believe that, but it is not our goal."

Miller also gave some history of Sustainable Woodstock that provided a historical context. The organization formed by combining two earlier movements in 2009. "One event that put us on the map and gained a lot of support was when Irene came through. There was flooding and some people were very much affected. Sustainable Woodstock took a lead in collecting donations and formed a committee to determine where the effort was most needed." The result was a greatly broadened public support.

LOW INCOME HOUSEHOLDS

One of the goals for the Energy Committee has been to reach out to low-income households. Even when people know that the help is available, they often do not know even where to begin doing the research on what they need to do to get it. And this is prehaps most often true of people with low incomes.

"We leveraged private funding with community support and state programs to weatherize homes for low income families." Zach Ralph told us. "We do our best to connect people to the programs that can help them best."

He also said two things worth note. One was, "You don't have to do everyhtign at once. Take care of the low hanging fruit." The other, particularly worth noting was "Maybe you take out a loan for $50 per month, but you could save $75 per month." Sustainable Woodstock has put special effort into finding ways to prepare people with restriced incomes, living in what is termed "energy poverty," to get those loans.

WEATHERIZING

The Sustainable Woodstock web site (https://www.sustainablewoodstock.org/) has information on a current program for weatherization. It says, "This winter, Sustainable Woodstock is teaming up with Vital Communities, Efficiency Vermont, and local home energy contractors to help residents in Woodstock, Pomfret, and Bridgewater save money and stay warm by weatherizing your home."

Weatherize Woodstock, which started a pilot program two years ago. There are many steps to get to weatherization, and the program helps people understand what efforts will be most helpful. It helps them go through the formulas used to calculate household energy usage and compare that to an efficent home. It put together a "Local Weatherization Guide," which a lot of information, along with a guide to resources, ranging from contractors and programs. Two organizations considered especially worth mention are SEVCA, Capstone Community Action.

Paige Heverly practices using spray foam insulation at a Sustainable Woodstock DIY interactive weatherization station.

Marsh-Billings House. Image Don Shall/Flickr

There is interest among the people to work on replacing mobile homes with net-zero housing similar to what Vermod has been building. GET published an article on such structures in December of 2016, "1st Solar with Storage at A Zero Energy Rental Development!" (http://bit.ly/GET-small-zero-energy)

Woodstock groups have been colaborating with others in nearby communities, particularly those in Vital Communities and its Weatherize Upper Valley program. There are many communities in Vermont and New Hampshire in this organization. Pomfret and Bridgewater are among those that have been working closely with Woodstock.

HEATING

Clearly, sustainable heating is vitally important. Sustainable Woodstock has been focused on a variety of resources. Air-source heat pumps are being used in the community, of course. Ron Miller also told us that a geothermal heat pump system was put into the Marsh-Billings-Rockefeller National Historical Park (MBR) a couple of months ago.

Scott Nichols of Tarm USA, Inc said that company is working on another project,

Cont'd >>


Zach Ralph

also at the Marsh-Billings-Rockefeller site. They are putting in biomass boilers in two buildings there and soon will be heating a third building there. as well.

Solarizing Woodstock has run two solarize projects and plans more. Catamount Solar and Integrity Energy worked on the first campaign, which started in October 2014 and ran through January 2015. Their efforts resulted in 25 homes installing solar power, totaling 165 kilowatts of new renewable energy generation. A second solarize campaign, also successful, came a year later. Barbara Barry and her husband, Michael Pacht took part of it as participants. We are told that more solarize campaigns will probably come along in the futuer.

TRANSPORTATION

In Vermont, 47% of all fossil fuel use is for transportation, making it the single most important issue to face in reducing carbon emissions. It is also thought to be possibly the most difficult to deal with.

Zach Ralph told us that Sustainable Woodstock has been looking into transportation for a few years and has been considering several approaches. Some board members have been exploring ride sharing opportunities. Commercial programs like Uber are one approach, but there may be others that could work well in a small Vermont town.

Another possibility that is starting to be considered is a "village to village" shuttle service. This could be privately funded or could have municipal involvement.

Other ways to approach transportation range from walking and biking to battery powered vehicles. There are many ways to address the transportation issues, and Sustainable Woodstock seems interested in understanding them all.

AGRICULTURE AND GARDENING

Some members of Sustainable Woodstock have taken interest in sustainable agriculture and gardening. According to Ron Miller, the town has two community gardens serving about 40 families. It has also published a local farm and food guide for several years. This effort has also included farm to table education, so people can get the freshest foods possible.

FORESTRY & CARBON SEQUESTRATION

Zach Ralph said some of the people of Woodstock have taken special interest in forestry and carbon sequestration. This, of course, is very much in line with the thinking of George Perkings Marsh, who started interesting people in sustainability both locally in Woodstock and nationally over 150 years ago. He said, "We have an opport unity to be proactive in managing fossil fuels and carbon emissions. Managing forests to store carbon cand create an economy around carbon."

Sustainable Woodstock has started the "Carbon Work-Study Series," monthly meetings running from February to August of this year. It has help in this from the Marsh-Billings-Rockefeller National Historical Park. Barbara Berry told us, "The main goal of the series is to get people in the area to understand the benefits of the trees, really talking about carbon sequestiration and micro systems. Anybody can participate." For information, you can visit http://bit.ly/carbon-work-study.


Dr. William Keetons explains carbon sequestration at MBR land

MORE:

Ron Miller also told us about a land reclaimation projected called the East End Development at a site on the Ottauquechee River that had once had a railroad station and a used car lot. In years past, the town had used it to dump snow, which polluted it further. An action group has been working for several years to turn the land into a park. It has also put out a guide for developers who might be interested int his part of the town.

Select Board member Jill Davies may have summed up everything the town is working on, saying, *"Everything we are doing is for resiliency."* ♻

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Heating Your Home (or Business) on the Cheap

– From the Ground Up (or Down) –

By Greg Whitchurch

The circulation piping and smaller bore hole of Dandelion's geothermal solution. Images: Becky Meier

This is a tale of two apparently parallel lives which, on one fateful day just north of New York City, collided, creating a tsunami of life-changing consequences for them, their neighbors, friends – indeed, the whole countryside!

Player One is Becky Meier: longtime public servant teaching our young in a public school for decades; retiring to assist immigrants to our country; now working at a community college - all socially responsible positions.

Player Two is Kathy Hunnan: native of New Hampshire; B.S. Civil Engineering, M.S. Theoretical Computer Sci. from Stanford. She lands a job at Google X ("moonshot" projects, etc.) and while there helps create what turns out to be Dandelion, where she is CEO. And now she must find her first "customer."

Back to Becky, who's been bitten by the social protest bug. Without warning, interlopers have proposed a multi-billion dollar natural gas pipeline through her community! And she's "not going to take it anymore." So she and her partner, Bob, create StopNYPipeline.org/ for the fight. They win; the proposal is withdrawn. BUT, now she's hooked on social action. So next they set up a local Renewable Energy Fair. Suddenly, Aztech Geothermal buys a booth!

A typical geothermal heat pump whole house furnace. Courtesy image: Water Furnace.

The Day of the Energy Fair: Becky and Bob happen across Aztech's booth. They're awakened to the promise of geothermal! Becky invites them to speak to her anti-fracking group. Unbeknownst to Becky, Kathy has chosen Aztech as Dandelion's installation partner.

The Day of the Presentation: John Ciovacco, Aztech's President, just happens to bring along Dandelion! Kathy has cast her line. *SNAP!* Becky takes the bait - hook, line and sinker.

Pumping the sludge from prehistoric garbage (oil) out of the ground, transporting it all over the world, refining it, transporting it some more, and then using our breathing air to burn it (inefficiently, no less) to heat our buildings, and finally pumping the poisonous exhaust back out into our breathing air doesn't make as much sense as just pulling the heat itself out of the ground. To address this problem, Alphabet X (Google) created a project, Dandelion, as a "moonshot" to design a specialized procedure to make geothermal heating and cooling affordable for everyone - residential and commercial, rich and poor.

As you probably already know, a heat pump (e.g. air conditioner, refrigerator) simply moves heat from one place to another; but keep in mind that it concentrates the heat during the process. The unwanted heat in your fridge is concentrated and moved outside the fridge into your kitchen, replacing it with very cold air. Likewise, with a geothermal heat pump, 50-degree heat from the ground is concentrated to a higher temperature in order to heat your house while the ground is, in turn, cooled down a bit.

Before Dandelion, geothermal installations cost tens of thousands of dollars because well-drilling tools were used, which are much larger, harder to transport and to move into place, and it takes far longer to drill than is necessary for a geothermal installation. Dandelion invented a small drilling rig for the smaller, shallower drill-hole needs of geothermal. This rig is far faster (one day of drilling vs. three to four days), easier to drill multiple holes, to transport, and to tuck into restricted places - saving a LOT of the typical costs while making it more widely available to folks with difficult sites. Horizontal layouts are also used.

At this early point in its development, DandelionEnergy.com exists only in upstate New York and works with a limited array of installation firms. As they fine-tune their business model they are looking for clients with existing ductwork - of the sort one finds in homes with oil or gas furnaces. Although they have millions of dollar's worth of projects lined up already, they're actively working on branching out to surrounding areas and states in the Northeast. You can sign up as a potential client on their website - perhaps bringing their attention to your own area. They'll keep you apprised of their operations and offerings.

Those of you familiar with the structured financing used by SunCommon.com (solar PV) will recognize some of the features in Dandelion's offering. One can pay cash or use bank finance for ownership of the system right up front; or utilize their "Zero Down, Savings Today" quasi-leasing model. This would mean that as a homeowner's (or business owner's) energy bills shed the fossil fuel heating portion altogether, a (perhaps much) smaller amount would be paid to Dandelion each month - half in Becky's case! This amount would not vary like the price of fossil fuel does. At the end of the contracted leasing period the system belongs to the homeowner.

So, no fuel deliveries, storage, leaks, burner tune-ups, chimney worries, indoor fires or carbon monoxide, tank truck not getting up your drive, or bills landing on the kitchen table at inopportune times. And, the increase in electrical use can be offset by solar PV, which can also be scaled up to eliminate the rest of the electric bill. Keep in mind that the summer fans and window air-conditioners are gone, too. (Becky used to buy her electricity from renewable sources; now she's buying about 40 panels at a local community solar farm to offset everything.) By the way, one can also add on hot water and fresh air filtering and circulation to this same system. And you can monitor the system, as well as your home, from over the Internet.

The village of Rhinebeck, NY has voted unanimously to give Dandelion right-of-way access to install geothermal piping along city streets at no upfront cost to anyone! Then homeowners can opt into the system, as folks now opt into water and gas mains. On February 9th, 2018 Congress passed legislation to extend federal tax credits for commercial and residential geothermal installations through 2021. There are state and utility-based incentives as well.

[Note: this is a startup company; their offerings and procedures are undergoing fine-tuning right now. So expect some adjustments from the arrangements they made with Becky Meier. Links and more info available in the online posting of this article at the GET website.]

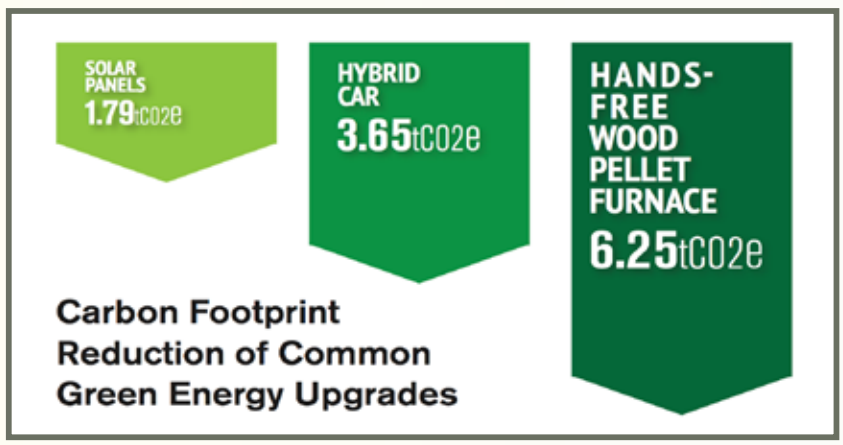
View the online version of this article at www.greenenergytimes.org to see links and more information on this topic.

For decades Greg Whitchurch is a board member of Vermont Passive House and owns a LEAF, a Prius and a net-zero passive house with solar PV and hot water in Middlesex, VT. http://bit.ly/2nRCdGL (802)223-2416.

Wood Pellet Central Heating Systems

MARKET AWARENESS

By Jeff Rubin



Note: tCO2e: Tons of carbon dioxide equivalent, which is a measure that allows you to compare the emissions of other greenhouse gases relative to one unit of CO2. It is calculated by multiplying the greenhouse gas's emissions by its 100-year global warming potential. Get the data behind the graphic at http://bit.ly/sustainableheating_CarbonGraphic.

Question: What is the most effective driver of green energy adoption? Answer: Knowing what your neighbor does. Some things are more readily known than others: each new solar array provides increased social proof, while each new pellet heating system remains hidden away in someone's basement.

Invisibility isn't the only barrier to market adoption for pellet furnaces. Homeowners have a range of aptitudes about what goes on down in the basement. Central heating systems are not a consumer item, and there's too much technical jargon. (Do you know the difference between a boiler and a furnace?) There is also a widespread concern that we will cut down all the trees instead of there being an understanding of how the market for secondary lumber supports sustainable forests. (Most people don't realize that most U.S. forests are not protected, and that over one third are in current use, and that secondary lumber is fully 70% of harvesting. More on this at http://sustainableheating.org/sustainable-forestry/). Then there is our well-worn reflex to complete the phrase "wood pellet" with "stove." Wood pellet stoves and wood stoves play a vital role, especially when combined with cold climate heat pumps and tight building envelopes, but by far, the biggest opportunity in green energy is switching from an oil furnace to one that runs on wood pellets. Today we still have 60 million homes burning 3.6 billion gallons of heating oil annually.

From the mills that make the pellets, to the pneumatic trucks and storage bins that deliver entirely hands-free heating, to the amazing green-tech boilers and furnaces—the wood pellet central heating industry has had a fully functional infrastructure in New England for more than a decade. We don't have a technology problem, but we do have some marketing challenges.

Behavioral economics has shown that we don't always (or even often) behave in our rational, economic self-interest (yes, I know it's hard to believe!). Instead we are driven to connect with tribes of people who believe what we believe. We seek to increase our social capital with our group by appearing insightful and altruistic. In other words, we are intrinsically driven to share new, relevant information with our networks. Wood pellet furnaces are exactly the kind of disruptive technology that should be organically contagious in this climate of environmental concern.

The good news is that we are making progress! Most northeastern states have financial incentives for pellet boilers/furnaces. Pellet heating systems qualify for low-cost green energy loans and can often be rolled into your mortgage payment. There's plenty of information on the internet. One good place to start is http://sustainableheating.org/. We are at a critical moment in the story of climate change, and we can't bend the curve unless we address pollution from heating our homes and businesses.

Jeff Rubin is Executive Director at Sustainable Heating Outreach & Education, Inc., a nonprofit advocacy 501(c)(3), sustainableheating.org.

Hands-free, environmentally-responsible wood pellet central heating fuel delivery. Image: Sustainable Heating Outreach & Education, Inc.

EZ FIRELOGS are Just Easy

By George Harvey

There was a time in my life when I cut, hauled, split, stacked, and burned my own firewood to heat a house in which I lived with four children. That was not easy.

I loved cooking with a wood stove, but it required constant attention; there was no such thing as setting the oven thermostat to 325ºF and walking away for an hour. There was always a risk of bringing in insects and a certainty of dropping bits of bark on the floor. The chimneys needed to be cleaned. Even with the low cost, heating with wood had its down sides.

Pellet stoves, which have few of those problems, came along a little later. In a way, they are based on wood chemistry. The three main chemical components of wood, cellulose, hemicellulose, and lignin are naturally formed polymers, and of these, the lignin is actually a thermoplastic and can act as a glue-like binder. Because of this, sawdust can be heated and pressed through extruders to form wood pellets.

There are a number of advantages of wood pellets, not the least of which is that you can feed them into a fire box with an augur, so a pellet stove can be left to run automatically for hours. Nevertheless, pellet stoves are not all they could be. They may not be as pretty as open fireplaces, people do not generally toast marshmallows with them, and it seems no one is making pellet kitchen ranges. Nevertheless, they have a list of undeniable advantages.

High and consistent heat output, low moisture in a tightly compacted log deliver a superior flame. Images courtesy of Mark Janinni.

The log is extruded at 400ºF and with 40,000 pounds of pressure per square inch. The owner of the EZ FireLogs company likes to refer to it as "hard luck."

Mark Jannini, who runs EZ Firelogs in Loudon, New Hampshire, explained a third alternative for wood-based heating to us, the Firelogs his company sells. In exactly the same way that wood pellets are pressed from sawdust and chips, it is possible to press fire logs of much larger dimensions than wood pellets, making them as long as they may be needed. While they cannot be fed into pellet stoves, they are conveniently sized for fireplaces, Franklin stoves, and kitchen ranges.

The EZ Firelogs have nearly all the advantages of wood pellets except automatic feeding. Since they are pressed at high temperature, they are very dry. This means that much less weight is needed to produce the same amount of heat, and less space is needed to store the same weight. The result is that the EZ Firelogs needed for a season take up about a third of the space needed for a season's cord wood. Also, because of the heat and pressure used to make them, insects do not survive the process. Because they have low water content, they burn cleanly, producing little ash or creosote; according to Jannini, they can acutally dry out old creosote in chimneys, causing it to fall loose. Their cost is similar to that of wood pellets.

While it is true that pellets can be fed automatically into a pellet stove, the EZ Firelogs have their own advantage that they can be used in stoves and fireplaces that are unaltered, matching the aesthetic qualities of cord wood but with a cleaner product. Since they are made entirely of wood, there are no chemicals that can cause problems in these stoves.

EZ Firelogs are made in New Hampshire, entirely from wood waste materials, such as sawdust. No trees are harmed to make them. More information can be found at http://www.ezfirelogs.com/. ♻

START-UP BUSINESS GROWTH IN CLIMATE ECONOMY

Accel-Vermont to Graduate First Climate Economy Business Cohort

Accel-VT cohort convene at Burlington Electric Department to help solve distributed energy challenges with the electric grid while honing business models for success in the marketplace. Courtesy Vermont Sustainable Jobs Fund.

Eight climate change innovation entrepreneurs participate in business accelerator to help solve distributed energy challenges with the electric grid while honing business models for success in the marketplace

Eight entrepreneurial start-up companies will convene next week at Burlington Electric Department's Spark Space for the final "sprint" of Accel-VT—a business accelerator providing support, mentorship, and access to capital for early stage companies committed to climate economy innovation. The businesses were competitively selected to participate in Accel-VT to help solve the challenges related to the monitoring and control of distributed energy (e.g., storage, electric vehicles, solar, community scale wind, combined heat and power) and include Packetized Energy of Burlington, Dynamic Organics of Putney, and businesses from Maine, New Jersey, Illinois, Georgia, Florida, and Texas.

In February, the third and final time this cohort of Accel-VT entrepreneurs is working together in person to improve their business plans, network with renewable energy industry leaders, meet with potential clients in Vermont electric utilities, and fast track their way to securing financial investments so they can grow or possibly relocate their business to Vermont. Additionally, two of the companies will be selected by their peers to each receive a $25,000 cash prize.

"Accel-VT entrepreneurs have really worked hard over the last 3 months to hone their investment pitch, strengthen their business and product value proposition, and learn to think like an investor. This will make it much easier for them to raise the capital they need to scale their company as now they better understand how to talk to investors," says Geoff Robertson, business assistance director at the Vermont Sustainable Jobs Fund.

Accel-VT is managed by the Vermont Sustainable Jobs Fund, a nonprofit organization working to improve sustainable economic development in Vermont. Partners include Burlington Electric Department and the Vermont Center for Emerging Technologies. Accel-VT launched at the Catalysts of the Climate Economy National Innovation Summit held in Burlington in September 2017, which focused on the challenges presented by climate change as opportunities for economic growth for climate solution businesses in Vermont.

"Accel-VT serves as a compelling example of how Vermont utilities are partnering to foster energy innovation for the benefit of our customers," said Neale Lunderville, general manager of Burlington Electric Department. "As the first city in the nation to source 100 percent of its power through renewable generation, Burlington is a leader in moving our country away from fossil fuels. Accel-VT opens doors for energy entrepreneurs who share our goal of a greener planet, and these companies help boost economic development all around Vermont."

All of Vermont's 20 utilities (electric, gas, transmission, and efficiency) are interested in the solutions these entrepreneurs offer for electric grid stability, could be potential clients, and all serve as Accel-VT sponsors.

"The opportunity to make an impact on innovation within the renewable energy sector is greatest when you have key influencers across the industry working together – from utilities, research entities, investors and entrepreneurs," said David Bradbury, president of the Vermont Center for Emerging Technologies (VCET). "Accel-VT is the first coordinated initiative in 20 years to successfully bring these parties together, and VCET is enormously proud to be behind this initiative. The support and engagement of Accel-VT ranges from mentoring to advising to investing, and the outcomes are driving positive change in renewable energy for Vermont and across the country."

The Accel-VT curriculum was developed by Village Capital, a national business accelerator model designed for high-growth ventures solving major societal problems that want to raise money from venture capital investors. The goal is to enable the eight Accel-VT businesses to secure investments so they can bring their product to market swiftly and strategically partner with utilities and other renewable energy generation businesses to help solve the challenges related to the monitoring and control of distributed energy.

Learn more at www.accelvt.com.

The Vermont Sustainable Jobs Fund is a nonprofit organization committed to nurturing the sustainable development of Vermont's economy. VSJF provides business assistance, network development, strategic planning, and value chain facilitation in agriculture and food system, forest product, waste management, renewable energy, and environmental technology sectors. The Vermont Sustainable Jobs Fund was created by the Vermont Legislature in 1995 to partner with state government, private sector businesses, and nonprofits to build a thriving economic, social, and ecological future for Vermont. www.vsjf.org. ♻

Vermont Research Climate Change News

Skiing, Winter Olympics, Healthy VT, Farms & Water Safety

SKIING AND CLIMATE CHANGE

The impacts of climate change on Vermont's ski areas were modeled in an article in Tourism Management. The researchers looked at 103 ski areas in the Northeast, finding that many will not be viable by the middle of this century. See also recent reporting by Maine Public Radio1 and this EPA Vermont fact sheet2.

A recent study conducted by a group of UVM students3 synthesized a number of interviews into a narrative chronicling the impacts of a changing climate on average Vermonters. Some of the most frequently cited concerns related to the mental stress associated with rising tick populations and shorter ski seasons.

TOP MEDAL STATE

Vermont sends more athletes per capita to the winter games than any state in the U.S. And the state's winter medal count tops many countries. This week about 30 athletes with Vermont ties will be competing in Pyeongchang, South Korea. A new book, Norwich: One Tiny Vermont Town's Secret to Happiness and Excellence4, by New York Times reporter Karen Crouse looks at why Norwich has sent so many

athletes. The book argues that Norwich kids don't specialize, their parents are hands-off and it's about having fun over winning. See Interview with author5 on NPR's "Here and Now."

HEALTHY VERMONT, AGAIN!

Vermont was ranked the third healthiest state in America's Health Rankings Annual Report6, behind only Massachusetts and Hawaii. The strong performance was a sharp improvement from the first time the study was conducted in 1990, when the state ranked 20th. Some key findings from the report were the increase in premature deaths nationally7 for the third consecutive year—along with a rise in cardiovascular and drug deaths.

Contrasting with the nation's overall declining health in preterm births, Vermont was one of just four states, including New Hampshire, to earn an 'A' grade on the latest March of Dimes Birth Report Card8. Vermont had the lowest prematurity rate in the country at 7.3%. See the Vermont Biz article9 for more information.

FARMS AND WATER POLLUTION

A recent study points to significant relationships between proximity of farmstead and waterway and phosphorus levels10, as well as the trend of increased phosphorus levels associated with cover cropping. A group of Middlebury College students distributed a survey to 250 farms to report

management practices and utilized statistical software to relate these findings to Lake Champlain.

Reprinted with permission from the Center for Research on Vermont, February 7, 2018 edition of Vermont Research News.

Links available on the individual posting of this article on our website: www.greenenergytimes.org. ♻

The Weather Listens to No Man

By Dr. Alan K. Betts

The impact of accelerating climate change last year has been sobering. High temperatures and drought produced record fires in the western U.S., and the 2017 Atlantic hurricane season was devastating. Preliminary damage estimates are approaching $400 billion, twice as much as the 2005 hurricane season. At the end of the year, the Arctic vortex weakened and bitter cold spread across much of Canada and the eastern U.S. for weeks. The current U.S. administration declared the end of climate change, totally unaware of the warm temperatures across Eurasia.

Just ten days before Hurricane Harvey hit Texas, wreaking havoc and causing widespread flooding, the president signed an executive order revoking a set of regulations that would have made federally funded infrastructure less vulnerable to flooding. As a result much of the federal money sent to Texas to rebuild may be wasted on construction that will not protect against rising sea level and the increasing severity of storms.

Washington is facing many irreconcilable conflicts. This is not surprising because the weather doesn't listen to political denial. Just paying for these weather disasters is getting harder, as Congress cuts corporate taxes, rather than introduce an escalating fossil carbon tax to pay for the immense damage that lies ahead.

Strangely and unexpectedly, the background work of the federal government continues. The first volume of the Fourth National Climate Assessment was released on schedule in November (science2017.globalchange.gov/), as mandated by Congress 20 years ago. This excellent report is an authoritative assessment of the science of climate change, dealing with all aspects that affect the U.S. It is a joint effort of all the government agencies along with university researchers, and it is lengthy and very thorough (470 pages). It is an essential document for regional planning. Everything it says flatly contradicts the climate change denial of the executive branch, which was powerless to prevent its publication. Our dysfunctional administration in Washington will now try to figure out how to obstruct the publication of the second volume of this report. Scott Pruitt, EPA administrator, has suggested a red team/blue team debate as a review mechanism for the science, with a hostile red team of climate science critics, perhaps selected largely by the fossil fuel industry and the Heritage Institute. The clear intent is to turn a critical issue for the future of the U.S. and the planet into political theater to spread doubt and confusion. This in turn will lead to more tragedies in the future.

At the November climate change talks in Bonn (COP 23), the official U.S. delegation looked pathetic as it tried to promote the coal industry. The U.S. is now the only country in the world trying to withdraw from the 2015 Paris agreement, which we helped draft. Meanwhile Bloomberg, the former Mayor of New York City, and California Governor Jerry Brown presented the opposite message under the banner of America's Pledge, an initiative to mobilize states, cities, and companies to comply with the U.S. commitment to cut carbon dioxide emissions in the Paris agreement. So far 20 states and more than 50 cities and 1,400 businesses have signed.

Unfortunately, it is already clear that the Paris agreement needs to be strengthened if the world is to meet its climate goal of limiting the rise of global mean temperature to less than 2 degrees C (3.8F). After a plateau that lasted three years, the global emissions of CO2 appear to be rising again, when we actually need a 3% fall each year for many decades. So everything New England can do to accelerate the green energy transition will benefit us all.

At home here in Pittsford Vermont, we enjoyed the last of the Brussel sprouts and kale at Christmas, which I harvested before the first big snowstorm. My winter spinach is alive under glass and snow, and the rye cover crop is also now covered with snow. There is much we can do to store more carbon in the soil. This benefits the climate, and at the same time, the organic matter stores more water in the soil, which in turn reduces runoff and gives crops greater resilience against drought. We need to understand what is happening on a global scale, but it is critical for our children to develop the resilience of our local agriculture.

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

The damages to the infrastructure of Houston, Texas were massive and long-lasting from Hurricane Harvey. Image: transgriot.blogspot.se

Better Buildings by Design 2018

By Barb and Greg Whitchurch

We both attended Better Buildings by Design (BBD) in Burlington, VT as representatives of *Green Energy Times*. Having attended many sustainable building events, we can agree with many BBD attendees and vendors that BBD is becoming the premier conference venue for building science education in the Northeast.

This is the place where architects, builders, engineers, designers, contractors, vendors of services and materials and equipment, homeowners, government planners, educators, and students come to learn the current state-of-the art in building science and practice - as well as what's new and upcoming. Continuing education credits are available for professionals through attending the many, tightly focused, presentations given by experts in their fields from all over the country; sometimes the world. Vendors from Australia to Europe to Burlington show off their wares. We ourselves fit into the category of homeowners, but homeowners who learned enough to choose to build a Passive House when the opportunity arose.

Efficiency Vermont puts on this two-day shindig, and they have somehow improved it every year since its inception 20 years ago. Breakfast and lunch are provided both days; there's an enormous meet and greet networking event with a cash bar the first evening. This year saw almost 900 attendees from all over the U.S., and some from Canada. If you missed it this year, don't miss it next year.

The range of topics and approaches varies from the theoretical to the most practical. They cover residential and commercial; new builds and remodels. They examine what is under your house, inside the walls and roof, inside the basement, the air you breathe, the appliances and lights you use, the types of energy you use, and the upfront and long-term financial and health costs of every choice that is made during the design and construction of a building. They cover what is coming down the line regarding specialized materials and HVAC equipment; how to help your children avoid asthma and allergies; how to replace explosive, poisonous, expensive onsite fuel storage (gas, oil, propane) with cheaper renewables; how to reduce your monthly housing and energy costs by building or remodeling to a modern efficiency standard.

Unfortunately, the building profession is not regulated like the medical profession, or even as much as getting one's driver's license! The Vermont building code (RBES - residential building energy standard) is almost never enforced; and even if it were, it's not up to par with what is appropriate, affordable, safe and healthy. If you want to learn how to select a competent builder/designer/architect/contractor for something more complicated than a garage, come back in April when we'll take a look at some of those issues in our next issue of G.E.T. Meanwhile, take a look here: https://contractors.efficiencyvermont.com/bbd.

Barb and Greg Whitchurch are board members of Vermont Passive House and owners of a LEAF, a Prius and a net-zero passive house with solar PV & hot water in Middlesex, Vermont. http://bit.ly/2nRCdGL (802)223-2416. ♻

Batteries ...

Cont'd from p.12

they discharge. These features are similar across the brands of lithium batteries we recommend.

John Hassell has been suggesting SimpliPhi batteries for his customers. Co-author George Harvey has been struck by the social efforts Sonnen has made to help people in Puerto Rico. N. R. Mallery is considering RELiON batteries to replace her bank of lead-acid batteries. Clearly, all of these companies and batteries have their good points.

We should address whether lead-acid batteries are still a good option. The quick answer is yes, they do have their place. The low price of lead-acid batteries makes them attractive for many applications. The flooded batteries require regular maintenance, and it can determine how long they will last, though somewhat higher-priced gel and AGM batteries are nearly maintenance free. Solar installers might tell you to expect them to last six to seven years, but there are many folks that we have talked to whose batteries have lasted much longer.

Trojan batteries in particular, the ones most old-time off-gridders are familiar with, are known for their ability to handle daily charging and discharging cycles. Our eyes are definitely on the new renewable energy offerings from Trojan Battery that have a much longer life expectancy than we have seen in the past. Check out their ad on page 12.

Another tried and true standard is the Rolls Battery that many solar installers in our region recommend. RAE Battery Storage is the go-to company for Rolls and offers some of the best service around the northeast. (See ad on page 13) The owner of the company, Roy A. Early, has been working with lead-acid batteries longer than most of us have been alive. He is happy to share his deep knowledge of these batteries with anyone considering them. He tells a story of batteries in the Philippines that have been continually used for over 35 years. The island depends on the batteries for their energy storage and have performed extremely high levels of the proper maintenance to make them last so long – that they learned from Early.

Many customers still favor batteries from Trojan or Rolls Surrette with good reasons that start with affordability and a solid history of performance. They are, however, different from lithium batteries. You should do a side-by-side comparison of features before buying.

Another technology that deserves mention is nickel-iron. Iron Edison has said that customers who buy nickel-iron battery systems will probably never have to replace them. As we said above, they also offer Lithium Phosphate LiFePO4 options.

We hope this information is helpful to you. If you have questions, do call the companies that offer them to get answers that are particular for your situation. Contact info for our recommended brands are: RELiON Batteries: relionbattery.com; SimpliPhi: simpliphipower.com; Sonnen: sonnen-batterie.com Iron Edison: ironedison.com..

And do take note that battery systems qualify for a 30% federal tax rebate! ♻

The Foam Factor

After the big one hits, here's how to keep residential flood and water damage to a minimum.

The dry look. Closed-cell spray foam such as Icynene ProSeal can act as a water-resistant barrier and provide additional "racking" strength vs. high winds. Image: Icynene.

Across the U.S.A. and Canada, heavy rainfall and flooding have caused millions of dollars in damage, lost revenue, damaged crops and homes. Hurricane Harvey ravaged southern Texas and the nation's fourth largest city, Houston, flooding vast areas of the region—and Hurricane Irma pounded Florida, Puerto Rico and much of the Caribbean with high winds and a downpour. In British Columbia, a tough spell of raging wildfires over the summer made heavy rainfalls a greater threat in fall.

Water ingress resulting from storm surges, high rainfalls and flooding can cause massive damage to the typical home. When water ingress occurs from extreme weather events, it becomes necessary to assess the extent of damage and contamination, debris removal requirements, and how to reconstruct or repair to reduce probability of similar damage in the future.

Power cells

When seeking methods to reduce the risk of water ingress, spray foam insulation is often overlooked as a comprehensive solution that can help play a role to keep out moisture and deter flood damage. However, spray foam insulation can be a key component in the design of building assemblies against future disaster-driven damage. Both open-cell and closed-cell spray foam insulation can be used throughout a residential or commercial structure to manage and minimize moisture ingress.

When it comes to addressing moisture, open cell foam is better suited for use against building materials that can be damaged by water buildup.

When applied against these types of materials (e.g., exterior wood sheathing), particularly in hot or humid climates, insulation should allow just enough moisture diffusion to occur to let adjacent building materials breathe, preventing moisture entrapment.

Open-cell foam delivers this "breathability" and allows building materials to dry, minimizing moisture buildup and related problems, such as mold.

For example, in scenarios where the foam is applied to the underside of a roof deck, in the event of a roof leak water drains straight through the insulation by gravity rather than being trapped against the roof sheathing where it could contribute to roof rot. Upon drying, some open-cell spray foam insulation products return to their original state without warping or distortion, and the effectiveness of the insulation is restored to its original performance potential.

The Federal Emergency Management Agency (FEMA) has identified closed-cell spray foam as a flood-resistant material due to its resilience and strength. According to the government agency, flood-resistant material is any building material capable of withstanding direct and prolonged contact with floodwaters without sustaining significant damage. Closed-cell spray foam can be used as a water- resistant barrier to help deflect moisture and provide additional "racking" strength to help resist the high winds of a storm or hurricane.

Dealing with flooding's aftermath

When assessing flood damage, one must almost always assume that the water contains contaminants, such as decaying organic matter and debris, raw sewage, fuel, solvents, microbes and mold. Through wicking, moisture and contaminants can be drawn into areas above the actual flood level. Even after cleanup, homeowners

Cont'd on p.27 >>

<< Cont'd from p.26

may still notice problems with housing elements, since mold and other contaminants can be present due to wicking and therefore may render homes unlivable.

Cleaning up after a flood should involve an assessment of the extent of removals required, necessary cleaning, drying and disinfecting of surfaces by a qualified contractor. Some porous materials may take days or even weeks to carry out. Mold can begin to thrive in as little as forty-eight hours when contaminated water floods an assembly. This makes it likely that many porous materials will, in fact, require removal after an extreme weather event.

Repair work following water ingress or flooding will often involve raising older buildings and constructing new ones on piers or platforms above the Base Flood Elevation (BFE). Construction below the BFE must be done with flood-resistant materials. Closed-cell spray foam insulation is suitable for application below the BFE.

Above the BFE, both open-cell and closed-cell spray foams can be used, but consideration has to be given to avoiding other porous materials that can absorb contaminated water. The choice of materials should be made based on sound building-science principles. For instance, in a floor above a damp crawlspace, it may be desirable to use closed-cell foam because of its vapor retarding, compressive strength and water-resistant characteristics. A qualified and experienced insulation contractor is able to help work through the best approach.

Most of all, building materials exposed to flooding must be resilient enough to sustain a certain amount of water exposure to avoid the need for complete replacement. A "repair and prepare" approach using spray foam insulation can help reduce risk of water ingress and damage, as weather patterns across North America continue to change and challenge our approach in designing and building sound, solid structures to live, work and play in.

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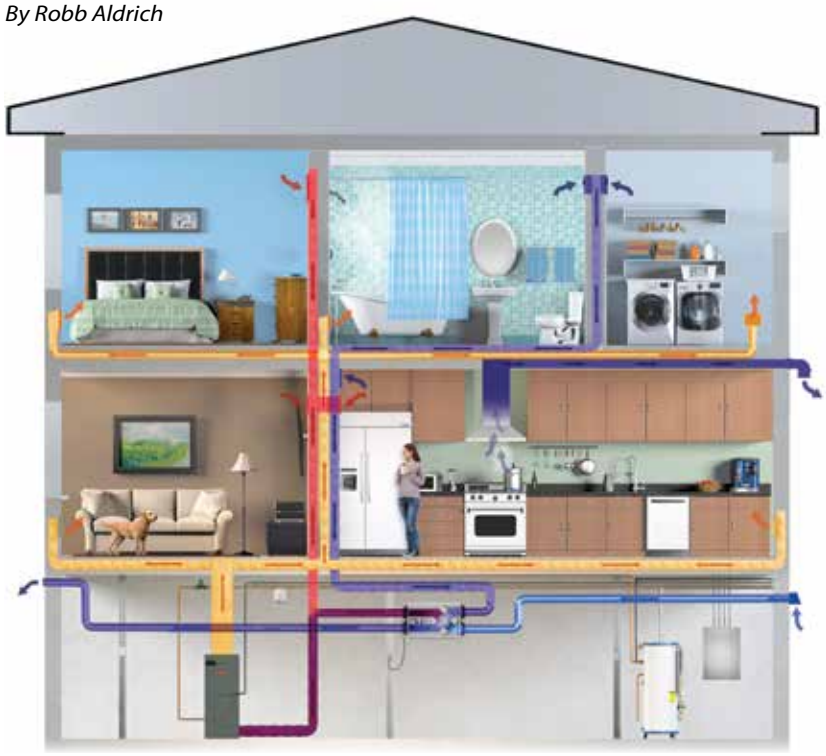
Steven Winter Associates

"Ideal" Home Ventilation

By Robb Aldrich



The superior choice for the most energy efficient ventilation is an Energy Recovery Ventilator (ERV). ERVs use a balanced approach to exhaust and supply air, achieving good indoor air quality while saving energy. Image: RenewAire.

Residential ventilation can be a tricky topic, and I often try to discuss it in terms of practical, cost-effective, and holistic solutions. However, it is also important to clarify the purpose of proper ventilation and what an ideal system might look like in a new, efficient home. In both single-family and multifamily homes, an ideal system would be similar – keeping in mind that practical issues can be quite different.

The purpose of ventilation is to remove contaminants that can compromise health, comfort, productivity, durability, etc. There are other ways to lower contaminant levels aside from ventilation that should be noted. Emitting fewer contaminants from materials and activities is obviously good. We all should be doing that. Also, actively filtering, adsorbing, or otherwise removing contaminants from indoor air can certainly help, and that is another lengthy topic entirely. For most new residential buildings, mechanical ventilation is still the primary means to remove contaminants for now, or at least it's the primary method that designers and developers need to plan.

If building a new, efficient home in an idealized Shangri-La, my ideal ventilation systems would look like this.

BATHROOMS

Each bathroom would have an exhaust fan that draws roughly 80 cubic feet per minute (cfm). For decadent bathrooms with multiple showerheads, big whirlpools, etc., you may want more, but for most of us, 80 cfm is sufficient. These bathroom fans would remove moisture, odors, etc. to the outside. They would have humidity sensors, or at least controls in place to continue running several minutes after a shower. They would and should still have the ability to be manually operated by the occupant.

KITCHENS

Kitchens would have range hoods with good capture efficiency that exhaust 200 to 250 cfm directly outdoors. Because these hoods would be in new, efficient, and airtight homes and apartments, you cannot draw out 200-250 cfm without providing makeup air. This would probably require a separate duct to outdoors with a damper, a fan, and an electric resistance element to temper the air when it's very cold outside. As we are still in my Shangri-La, this heating element would only operate when outdoor temperatures dip below 40∞F, and it would modulate to maintain discharge temperature of ~70°F as to not waste electricity. The range hood – and ensuing makeup air system – would activate automatically when heat or cooking contaminants are detected above the range.

CONTINUOUS VENTILATION

In addition to local ventilation, continuous ventilation is still needed to dilute contaminants throughout the home. For this you want an energy recovery ventilator (ERV) or a heat recovery ventilator (HRV). These ventilators save or "recover" a significant share of the heat that might otherwise be exhausted by the ventilation process, heat that would need to be created by the building's heating systems. You want a H/ERV with low power consumption and good heat recovery effectiveness (at least 80% sensible, 60% total for an ERV).

At a minimum, the H/ERV air flow should deliver what is required by the ASHRAE 62.2 standard. In our ideal home, however, we want to be able to boost this rate by two to three times. Even better, there would be a control system that senses concentrations of key contaminants and can boost the ventilation rate automatically. In an ideal multifamily building, each apartment would still have its own H/ERV so there are no issues balancing flow rates across dozens or hundreds of apartments.

Fresh air from an H/ERV would be distributed around the home by ducting or some other mechanical mixing system. If local exhaust is accounted for, there is not much difference where you exhaust and supply. It does not take much air flow to equalize contaminant levels throughout a home.

For all ventilation systems, fans would be powered by very efficient, variable-speed motors. All systems could be boosted or manually controlled by occupants as needed.

All this said, there are significant challenges of the ideal system outlined here. From cost, to wall penetrations, maintenance, and space (and back to cost), the scenario is not practical or affordable in many situations – especially multifamily buildings. Some of the "ideal" controls mentioned don't exist (yet). I don't see systems like this often; when I do they're typically in custom, high-end homes. But when thinking about indoor air quality and energy efficiency, this is what I would aim for if designing a new home for myself. And I think it's useful to keep an ideal in mind when designing something realistic.

Robb Aldrich is a Principal Mechanical Engineer for Steven Winter Associates. ♻

Many thanks to our Sponsor:

RenewAire Energy Recovery Ventilation

Green River Commons — Condominiums in Greenfield, Mass.

By George Harvey

In August of 2015, Green Energy Times ran an article about the R. W. Kern Center, at Hampshire College in Amherst, Massachusetts. That article, "This is How You Do It" (http://bit.ly/GET-this-is-how), described what might be the toughest and most inspired standard around for sustainable buildings, the Living Building Challenge (LBC).

That article also brought into sharper focus Wright Builders, Inc. in Northampton, Massachusetts, which was the general contractor for the Kern project as well as the Hitchcock Center for the Environment, both in Amherst, Massachusetts, and both LBC projects. I called the International Living Future Institute, which administers the LBC, and asked a simple question, "Has anyone ever done this before?" They were quite surprised by a single builder undertaking the challenge on two buildings at once. They had never expected it would happen.

Wright Builders, Inc. works not only for institutions, but builds and develops homes for all sorts of people on a range of income levels. They are working now a new project that perfectly exemplifies this, a seven-unit condominium designed to be kind both to the environment and to the occupants' pocket books. Moderate income people often do not have access to the best of building science and design. Collaborating with the Town of Greenfield, Massachusetts, Wright Builders is working to change that.

The Green River Homes community are seven sustainable, comfortable, and beautiful one level condominium townhomes with easy access to public transportation and downtown Greenfield, MA. Courtesy photo.

Green River Commons in Greenfield, developed by Green River Homes, LLC and constructed by Wright Builders, consists of two buildings, one of three units and the other of four.

They are sited close to shopping, regional transportation, some great restaurants, theater, and the arts of a great community. The condominiums have indigenous landscaping, off-street parking, river views, and comfortable interiors featuring wood and tile flooring.

What I find loveliest about this is that the homes can be occupied without any sense of guilt about environmental effects. They are built to a standard Wright Builders calls "net zero capable." What this means is that when all the demands for energy are combined, they can be offset by a solar installation on the roofs.

The double wall construction, cellulose insulation, Pella triple glazing, air sealing, and orientation are designed so that the heating and cooling needs can be covered by energy coming from the rooftop solar. The lighting, appliances, and other needs for electricity are also supplied from the same solar. The homes are equipped with state of the art Mitsubishi heat pumps and Rheem hybrid water heaters, along with ERV systems for ventilation. The units will have HERS ratings estimated to be 44 or lower, which means they will require 44% of the energy required by a standard home built to current specifications, 11% less than the current code minimum requirement.

Each owner will have the opportunity for solar system ownership for no more in monthly cost than the projected energy bills, and with little or no down payment through the Massachusetts Clean Energy Center. The solar systems that will ultimately go onto the roofs are not pre-installed, in order to afford buyers the optimum use of grants and tax credits for their own benefit. That can be done in consultation with Pioneer Valley Photovoltaics, a locally owned Coop that is considered an industry leader.

Wright Builders and Green River Homes are partnered with Freedom Credit Union for construction and customer financing needs.

All the homes are built to the same identical standard. Three of the home's costs are labeled "market rate," while the other four are defined as affordable to families at 80% of median income. The prices range from $145,000 to $200,000 for one and two-bedroom homes, with areas of 560 and 720 square feet respectively.

To learn more visit their website at: http://bit.ly/green-river-commons.

Tortorice's Tips: Spend Now for Future Savings

By Bob Tortorice

With the cold winter, it's a good time to review and share the value of an energy audit and energy improvements and learn why it's important to make home improvements now in anticipation of future hot summers and cold winters.

Save Money on Your Energy Bills

The qualified home energy professional is trained to pinpoint the areas of your home where energy is being wasted and used inefficiently. The resulting energy audit will prioritize cost-effective improvement opportunities that will pay financial dividends every season. The colder or hotter it gets outside will only increase your savings.

Increase Your Comfort

You will feel the difference with the right home improvements. No more drafts, cold or hot spots. Air sealing the building shell, sealing leaky air ducts, adding insulation, or replacing that old furnace or air conditioner will make your home a more pleasant place to be. Remember how hot your second floor bedrooms get in the summer! Who knows how hot this summer will be?

Increase Your Home's Resale Value

For every $1 decrease in annual energy costs, the market value of a home increases by $20, according to a study published in the Appraisal Journal. If you decrease your energy costs by $300 per year, the value of your home increases by $6,000. After the work is completed, the qualified professional will verify measurable results of the improvements performed.

Measures to lower utility bills are valuable home improvements that reap dividends month after month. Your home is more likely to make a faster sale for a higher price when you're ready to sell.

Uncover Hidden Problems

A home energy audit involves a thorough inspection of your home, which can uncover hidden structural and safety problems before they cause major damage. For example, improper ventilation can cause mold or mildew growth, which you may not discover until it becomes severe, and costly repairs are required.

Help the Environment

By using less energy, you reduce the amount of pollution and greenhouse gasses that are created in the production of electricity and the fuels we burn. You can feel good about the energy (and money) you're saving because you're doing your part for the environment.

Take Advantage of Government and/or Utility Company Incentives

While you don't necessarily need a home energy audit in order to take advantage of government tax incentives and rebates, an energy auditor will show you which cost-effective improvements make the most sense for your home. With the recommendations from your energy audit report and tax incentive information, you can make the right decisions as to which measures will pay the biggest return on your investment — and have the government and possibly your utility company help you do it.

Invest in a Sure Moneymaker

Investing in your home's energy efficiency takes money. Fortunately, your return on investment is around 16% per year, taking into account the money you spent on the improvements. As energy prices rise, so will your return on investment. Energy improvements have reduced home energy bills from 25% to over 50% depending on the home and scope of work.

Bob Tortorice has over 30 years of green building experience. He is the owner of Building Alternatives, Inc. and Alternative Energy Audits in Franconia. Call 823-5100 or visit www.buildingalternatives.com or www.epsbuildings.com to learn more about "Building Life Long Savings."

New Hampshire Lawmakers to Adopt Clean Energy Practices

More than fifty New Hampshire businesses are calling in a letter for the New Hampshire Legislature to advance clean energy policies that they say will support economic growth and business development.

Dartmouth-Hitchcock, Hypertherm, Hannaford Supermarkets, Velcro Companies, Timberland and Worthen Industries are among the businesses that have signed on to a series of "Clean Energy Principles" and sent a letter highlighting those principles to state lawmakers.

As businesses and employers invested in New Hampshire, we believe that transitioning to a clean energy economy will improve our own competitiveness and our state's prosperity, health and security," the letter begins.

It then lists the five principles:

- Energy efficiency and clean energy solutions are essential to our businesses. Strengthening investments in market-driven clean energy programs will help New Hampshire businesses be more competitive and grow our workforce.
- Clean energy solutions help us protect the beautiful natural resources of our state, our tourism economy, our health and our way of life.
- Strong state policies to enhance access to energy efficiency and renewable energy will shift our economy away from imported fossil fuels, reduce energy costs and support locally produced clean energy resources — keeping our energy dollars in New Hampshire's economy.
- Investments in energy efficiency and renewable energy make us more resilient by reducing exposure to fossil fuel price volatility."
- Developing clean energy systems and technologies to meet the needs of a changing global economy provides economic opportunities for the businesses and people of our state.

One of the businesses signing on to the letter is Wire Belt Company of America in Londonderry, whose CEO, David Greer, said, "Clean energy is good for businesses and New Hampshire's economy, and it is the right thing to do for our planet. Renewable energy helps businesses like ours compete with other states who have lower energy costs."

In fact, Greer said, "We plan to almost double the size of our rooftop solar system because it helps cut our energy costs and gives us more predictability."

According to Colleen Vien, sustainability director at Timberland, "access to renewable energy empowers businesses to make decisions and investments that benefit the environment, the economy and our bottom line."

New Hampshire currently ranks last among the New England states in energy-efficiency investment, and lawmakers have an opportunity to do more to help decrease demands on the energy grid — helping to reduce overall energy costs for all consumers, the businesses argue.

Michelle Veasey, executive director of New Hampshire Businesses for Social Responsibility and an organizer of the statement, said the signatories "are encouraging lawmakers to adopt policies that position New Hampshire to be competitive and innovative. Lawmakers have an opportunity to follow the lead of the private sector and put the state on a sustainable path towards a thriving economic future."

Another organizer of the statement, Alli Gold Roberts, senior manager for state policy at Ceres, a nonprofit that works with investors and businesses to promote sustainability initiatives and polices, said, "Investing in clean energy is good for business, and we applaud businesses for elevating their voices in support of strong, clean energy policy."

David Greer, with the rooftop solar system on his company, Wirebelt of America, says "I just love the stuff!" Image from Green Energy Times, December 2013.

Among businesses signing the letter: 36Creative; 7th Settlement Brewery; 900 Degrees Pizzeria Admix; Alnoba; AutoBeGreen; Bowst Interactive; Bruss Project Management; Co-op Food Stores; Dartmouth Hitchcock; Filtrine; FoodState; Gale River Motel; GDS Associates Inc.; Global Round Table Leadership; Good Start Packaging; Grappone Automotive; Gravity Group New England; Great Bay Community College; Green Alliance; Green Energy Options; Hannaford Supermarkets; Henry Whipple House; Hypertherm; mage 4; LighTec Inc.; Lucky & Me; Merritt & Merritt; MicroSpec Corp.; Nemo Equipment; NESG; New England Commercial Solar Services; Outdoor Industry Association; Pause, a Mindfulness Practice; Pax World Funds; Pete and Gerry's; Petersen Engineering; ReVision Energy; Ridgeview Construction; Stephenson Strategic Communications; Stonyfield Farm; Strategic Potential LLC; The Hvizda Team; Throwback Brewery; Timberland; Velcro Companies; Wire Belt Company of America; W.S. Badger and Co.; Worthen Industries; and Yes! Ventures.

Learn more at Visit http://bit.ly/NH-Businesses-SupportCleanEnergy. ♻

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wirebelt.

Unlocking Innovative Design for Better Schools

The Kathleen Grimm School for Leadership and Sustainability, New York City's first net-zero energy school building on the south shore of Staten Island. Image: www.arch2o.com.

The Advanced Energy Design Guide for K-12 School Buildings: Achieving Zero Energy (AEDG) was recently released to support elementary, middle, and high schools in their pursuit of zero energy performance goals for deep retrofits and new construction projects. The guide was published by ASHRAE and produced in collaboration with the American Institute of Architects (AIA), the Illuminating Engineering Society of North America (IES), and the U.S. Green Building Council (USGBC), with funding support from DOE and analysis conducted by the National Renewable Energy Laboratory (NREL).

Zero energy buildings, as defined by the Building Technologies Office, are extremely energy-efficient buildings that produce enough renewable energy onsite to meet annual consumption needs through a combination of innovative design strategies, efficient technologies, and improvements in the management of building operations. The AEDG provides technical guidance for school districts to take energy-efficiency goals from conception to fruition, and is meant to complement existing resources and strategies.

"Energy consumption is the second highest operational expense to schools each year, second only to salaries – reducing wasted energy in schools frees taxpayers' money to go towards more important and productive educational resources for students," said David Nemtzow, director of DOE's Building Technologies Office.

"This new design guide brings together proven, best practices to help architects, operators, and schools districts across the country find solutions that save energy and money."

The AEDG aims to demonstrate, as districts have already successfully exhibited, that zero- energy schools are attainable within budgets comparable to those of conventionally built schools, and provides project teams with the specific how-to knowledge, strategies, and solutions to design and construct better schools across the country. Prototypical models were developed through simulation software to determine target energy use intensity (EUI) for each climate zone in the U.S. and enable design teams to establish appropriate EUI goals for their own projects.

To support reaching specific EUI targets, the guide provides critical technical guidance for the design of building configurations and of building components, including the following:

- Building envelope and siting
- Fenestration
- Lighting systems
- Heating, ventilation, and air-condition ing (HVAC) systems
- Building automation and controls
- Outdoor air requirements
- Service water heating
- Renewable energy generation systems

The guide is intended for school stakeholders pursuing zero energy goals, including educators, school administrators, architects, design engineers, energy modelers, contractors, facility managers, and buildings operations professionals. Recognizing that many schools have limited staff and resources, the guide provides step-by-step direction to ensure that users start off on the right foot by focusing on four key components:

1. The Rationale for Zero Energy focuses on identifying the major stakeholders and outlining what it takes to successfully achieve a high-performance, zero energy school including key principles to implementation.
2. Keys to Success details how to achieve zero energy from a procedural standpoint highlighting the steps necessary for plan, design, and build phases, and how to engage a variety of stakeholders vital to the process.
3. Building Performance Simulation provides guidance on how to integrate building simulation into the design process.
4. How-to-Strategies delves into more technical aspects, users will be able to pull from specific strategies and recommendations for the design, construction, and operational phases as well as leverage guidance on troubleshooting and achieving energy targets.

As demonstrated throughout the guide, setting measurable goals is the first commitment a school district will make on a zero-energy journey. From there, zero energy design and construction strategies are an opportunity for school districts to promote fiscal responsibility while redirecting saved tax dollars to improvements that benefit students, teachers, and the districts as a whole.

To learn more, visit www.zeroenergy.org.

Reprinted from https://energy.gov/eere/buildings/articles/unlocking-innovative-design-better-schools. ♻

Building America Solution Center Celebrates Fifth Anniversary

Five Years and a Million Stronger

Image: Meritage Homes

Five years ago, Building America launched an interactive resource for high-performance home construction. Today, the Building Technologies Office's Building America Solution Center continues to skyrocket in popularity, growing from about 77,000 users in 2013 to more than 298,000 users in 2017. That's an increase of 287%! In total, Solution Center users are now approaching the one million mark, with 911,000 users and nearly two million page views since launch.

The Solution Center helps builders, contractors, code officials, and industry professionals put into practice lessons learned from Building America-sponsored research on hundreds of building- science-related topics. Researchers and practitioners can dig deeper into subjects in a library of nearly 1,000 technical reports, articles, code documents, and case studies of U.S. Department of Energy (DOE)-funded research on hundreds of high-performance residential building science topics. "Building America experts put building science on the map. Now, with the Solution Center, the entire construction industry can easily access all this expertise," said Eric Werling, Building America program director.

Since its launch, the Solution Center has grown to include more than 230 best practices guides offering step-by-step illustrated instructions for installing high-performance home measures. Topics range from the latest innovations to bread-and-butter measures such as insulating and air sealing. Builders and contractors can also find 1,600 photos and illustrations and more than 100 videos and presentations that can be shared with crew members through a mobile app for onsite training sessions.

Image: Thrive Home Builders

"This free, easy-to-use tool provides builders with access to current building science know-how from some of the brightest minds in the industry. It's like having a building scientist on your staff," said Sam Rashkin, chief architect for the DOE Building Technologies Office.

The country's top builders agree.

"The Building America Solution Center is full of best practices. Every guide in there is based on the right way to do things," said CR Herro, vice-president of environmental affairs with Meritage Homes, a production home builder with communities in nine western and southern states.

Gene Myers, CEO of Thrive Home Builders of Colorado, was named Professional Builder's 2017 Builder of the Year. He attributes part of his company's success to the Solution Center, saying: "We built our business on the shoulders of giants, including the Building America Solution Center."

Thrive's Vice-President for Sustainability Bill Rectanus said the company uses the Solution Center in several ways. Thrive's architects go to the Solution Center first when looking at ways to implement ENERGY STAR® and Zero Energy Ready Home requirements in new house designs. Site supervisors and crew chiefs use the Solution Center when they want to show crews how to implement energy-efficiency measures. Rectanus draws on the Solution Center when presenting at Thrive's company-wide weekly training sessions.

Builder Rick Wertheim of Long Island, NY especially appreciates the Solution Center's library of CAD files, which includes modifiable files that designers can customize and pop into house plans to give builders exact specifications on how to put together some of the trickier details of energy-efficient construction. "I've emailed them to the contractors and architects. It's so much easier if I can give them something that is already drawn," said Wertheim, senior vice-president of United Way of Long Island's Housing Development Corporation, a nonprofit organization that builds affordable housing.

Image: United Way Long Island

Wertheim also runs a United Way training center that teaches veterans and others energy-efficient construction skills so he often turns to the Solution Center for photos, videos, and installation guidance for his courses. To make sure the homes are energy efficient, healthful to live in, and long lasting, Long Island United Way builds all of its homes to the criteria of national home labeling programs like the Zero Energy Ready Home program, which requires that each home be certified to ENERGY STAR and EPA's Indoor airPLUS. Wertheim likes how the Solution Center includes interactive checklists for all of these programs in one place, which allow users to click on checklist items to jump to guides explaining how to construct or install each step.

As new resources are added, the Solution Center will continue to educate American builders across the country on high-performance home construction topics.

Reprinted from https://energy.gov/eere/buildings/articles/five-years-and-million-stronger. ♻

HAMPSHIRE COLLEGE IS POWERED BY SUNSHINE

By George Harvey

The Harold F. Johnson Library. Photo courtesy of Hampshire College.

Back in August of 2016, Green Energy Times (G.E.T.) introduced its readers to an exciting solar project in Amherst, Massachusetts in the article, "Huge Solar … Just in Time for Schools." (http://bit.ly/GET-huge-solar) The article led off with a section about a 4.7-megawatt array that was being built at Hampshire College. It has links to two earlier G.E.T. articles that featured sustainability efforts by Hampshire College, making it clear that the college has been working on the issue for some time.

Jonathan Lash, who had been head of the World Resources Institute, became president of Hampshire College in 2011. He immediately set about looking into solar power for the college. In those days, however, costs were too high and efficiency was too low for the project to be economically feasible.

Lash was very much aware of the environmental benefits of solar power. He was also aware of the fact that the price of solar power was declining rapidly. So the college revisited the issue in 2015 and found that the situation had changed. Solar power had become very attractive on a financial basis, and the decision was made to move ahead.

The college had a nearby piece of property that it could use for a solar system. Nineteen acres were used to install the 15,000 solar photovoltaic panels. The project was started in 2016, and it was completed late in 2017.

The array was installed by SolarCity, now a division of Tesla. Design work was provided by Solar Design Associates of Harvard, Massachusetts. One thing that we did not know about when the G.E.T. article ran in 2016 was that the installation would be supported by a number of Tesla batteries to even out loads for the college. The electricity produced is expected to be sufficient for all of the college's demands.

Under the terms of their contract, SolarCity will manage the solar array for Hampshire College. The college will pay SolarCity for electricity at a fixed rate of six cents per kilowatt-hour. This can be compared to the 13.5 cents per kilowatt-hour that Hampshire College has been paying for utility electricity. The contract is good for twenty years.

The savings to Hampshire College are considerable. Though it is not possible to calculate precisely how much the savings are given changing levels of usage and utility rates, Lash expects to save somewhere between $8 million and $10 million for the college.

Though the effect on the utility of having the college provide its own electricity is also not entirely known, Lash has said he believes it may be positive. The college will still be tied to the grid and will buy power from it or provide power to it according to current conditions. This means that with smart handling, the college can supply some power when grid demand is high, reducing the amount of high-cost power the utility will need to buy.

Lash pointed out that students participated in all of the decision making relating to the solar array. The more they are exposed to the design process and the issues of sustainability, the better prepared they will be for the future. And that, after all, is what education is all about. ♻

NH's Largest Solar

Cont'd from p.11

help the utility determine "whether such installations elsewhere on our system might make sense."

Also, after factoring in the cost of construction and the expected savings, the cost of power from the Moultonborough project will immediately have a "net cost on par with conventionally produced power."

The Moultonborough project also embraces environmental considerations, including leaving all stumps in place to prevent erosion; a perimeter fence with rounded instead of barbed wire, to protect deer. To keep deer out of the array field, the co-op has planted clover outside of it. The co-op also has built a berm on the outside of the array field to create a wildlife habitat and to mitigate the project's visual impact.

There have been some comparable projects: Completed in 2015, the 579-megawatt Solar Star project in California was the world's largest photovoltaic power station, but has since been eclipsed by the Tengger Desert Solar Park in China, which is producing 1500 megawatts.

While the co-op's Moultonborough project is the state's largest now, that distinction may not last long, because several larger projects have been proposed, among them a 65-megawatt photovoltaic facility in Hinsdale.

Barbara Whitchurch writes for Green Energy Times. *She is a board member of VT Passive House, drives an all-electric LEAF, and lives in Middlesex, VT.* ♻

Largest School Solar in NH: Phillips Exeter Academy!

1,552 solar panels at Phillips Exeter Academy, the largest school solar array in N.H. Courtesy image.

Phillips Exeter Academy is home to the largest solar array of any school in New Hampshire. The ballasted rooftop array was recently installed by ReVision Energy on the academy's new, 84,574-square-foot field house in Exeter.

Generating electricity with sunshine will save the academy more than $2 million in energy costs over the life of the system and will offset the majority of the athletic facility's electric load. The array consists of 1,552 solar panels and is the largest in Unitil's utility service territory.

"This large-scale array is a tangible example of the academy's commitment to sustainability, and it accelerates our state's clean energy transition," according to ReVision Energy events marketing specialist, Christina Zlotnick. "The array enables the athletic facility to control its energy costs and increase its energy independence by reducing the need to buy power generated with fossil fuels."

On an annual basis, the 535.44-kilowatt array will generate approximately 598,000 kilowatt hours of solar electricity. The average New Hampshire household uses 10,000 kilowatt hours of electricity per year, and the electricity produced by the array is enough to power 60 homes.

The solar power generated by the array will offset 629,694 lbs. of carbon pollution each year, which is equal to 700,060 miles driven by an average passenger car or 32,140 gallons of gas.

ReVision Energy collaborated with Harvey Construction Corporation on the field house modernization project. "The new field house at Phillips Exeter Academy is a textbook case for using technology and materials in creative and efficient ways to preserve the history of the campus while updating facilities central to the student experience and energy efficiency," said Bill Stevens, president of Harvey Construction.

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RESOURCES

350-Vermont: General group that coordinates a variety of statewide actions.
To join this group go to: **http://350vermont.org**
American Council for an Energy-Efficient Economy: Consumer guide to home energy savings - **aceee.org/consumer**
American Solar Energy Society (ASES): www.ases.org
Backwoods Solar: Specialty: solar, off-grid - **www.backwoodssolar.com**
Buildings Energy Data Book: buildingsdatabook.eren.doe.gov
Carbon Tax: carbontax.org
Clean Power Estimator: www.consumerenergycenter.org/renewables/estimator
CO2.Earth: See emissions harms, scientific advice, and pathways to follow. www.co2.earth
Consumer Guide to Home Energy Savings, Heating, Appliances, Refrigerator Guide, Building Envelope, Driving: http://aceee.org/consumer
Dept. Public Svc. (CEDF): publicservice.VT.gov/energy/ee_cleanenergyfund.html
Dsireusa.com: www.dsireusa.com Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency.
Efficiency VT: This is a must-go-to site for immeasurable amounts of info. **www.efficiencyVT.com**
Energy Efficiency & R/E Clearinghouse (EREC): eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html
Energy Efficiency & Renewable Energy Clearinghouse (EREC): eetd.lbl.gov
Energy Guide: Unbiased advice about today's energy choices. Find ways to save, lower your bills & help the earth's environment - **www.energyguide.com**
Energy Star Federal Tax Credits: www.energystar.gov/tax credits.
Federal Energy Regulatory Commission (FERC): www.ferc.gov
Federal Energy Regulatory Commission(FERC): www.ferc.gov
Find Solar: www.findsolar.com
Fossil Fuel Freedom: Group working to make Vermont's energy plan 100% free of fossil fuels:
To join this group go to: **groups.google.com/group/fossil-fuel-freedom-**
Greywater Info: www.oasisdesign.net/greywater
Home Energy Saver: Interactive site to help you identify & calculate energy savings opportunities in your home. A lot of great information! - **hes.lbl.gov**
Home Power Magazine: www.homepower.com
IREC/ Interstate Renewable Energy Council: RE educational info. **www.irecusa.org**
NABCEP/ North American Board of Certified Energy Practitioners: This organization that tests & certifies PV system installers. Individuals are Certified, companies are not. **www.nabcep.org**
NESEA/ Northeast Sustainable Energy Assoc.: www.nesea.org
National Association of Energy Service Co. (NAESCO): www.naesco.org
National Renewable Energy Laboratory (NREL): www.nrel.gov
National Solar Institute: www.nationalsolarinstitute.com
NeighborWorks® Alliance of Vermont: Low-cost energy loans - **www.vthomeownership.org**
New Hampshire Sustainable Energy Assoc. NHSEA Focused on N.E. US, for consumers & industry- RE & clean building info, events. **www.nhsea.org**
New York Solar Energy Industries Association/NYSEIA www.nyseia.org
NFRC independent rating & labeling system for the windows, doors, skylights **www.nfrc.org**/
NH Office of Energy and Planning: www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm
Renewable Energy World: www.renewableenergyworld.com
Renewable Energy Vermont: www.revermont.org
SEIA/ Solar Energy Industries Association: The SEIA Tax Manual to answer your solar related tax questions. **www.seia.org**
SmartPower: www.smartpower.org
Solar Components: www.solar-components.com
Solar Jobs: Listed by city, state, and district, **SolarStates.org**
Solar Living Source Book: realgoods.com/solar-living-sourcebook
Solar Power Rocks: Impressive data and info ,including per state. www.solarpowerrocks.com/
Solar Store of Greenfield, MA Stock & install a wide variety of solar & environmentally friendly technologies. **SolarStoreofGreenfield.com**
Tax Incentives Assistance Project (TIAP): www.energytaxincentives.org
The Energy Grid: www.pvwatts.org
The Office of Energy Efficiency & Renewable Energy (EERE): develops & deploys efficient & clean energy technologies that meet our nation's energy needs - **www.eere.energy.gov**
Track the Stimulus Money: www.recovery.gov/Pages/home.aspx
Vermont Energy and Climate Action Network (VECAN): works to start and support town energy committees as a powerful, people-powered response to realizing a clean energy future. www.vecan.net.
Vermont Tar Sands Action: Group working to stop the XL Pipeline and any other developments stemming from the Alberta Tar Sands. To join this group go to: **groups.google.com/group/vt-tar-sands-action**
VPIRG: understand the clean energy resources available to VT - **www.vpirg.org/cleanenergyguide**
VT Energy Investment Corporation (VEIC): nonprofit organization that issues home energy ratings for new & existing homes. 800-639-6069 - **www.veic.org**
Weatherization, Energy Star & Refrigerator Guide: www.waptac.org
www.susdesign.com Online info for solar benefit with house design: overhangs, sun angle & path…

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BIRTHSTONES AND VALENTINES

Hey, you February/March babies: Check out my birthstone jewelry (amethyst/ aquamarine) at The Hive, an artist collective in Middlesex, VT on Route 2 at the Red Hen complex. You can also go to my website (www.woolybearvt) or write to me at barbara.whitchurch@gmail.com to receive some photos. Feminine, funky designs and AAA quality stones are my hallmark. Check out my Instagram feed for current pics: barbara.woolybear. Barbara Whitchurch, Owner/ Designer, Woolybear Studio.

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SECONDHAND SOLAR

Pre-owned solar equipment for sale: Enphase m210 - $50; (1) Enphase m190 - $40; (2) Enphase m215 - $50; (2) Solectria PVI 5000S - $500; (2) SunnyBoy 6000 - $300; (1) Xantrex/Schneider XW-MPPT - $125; (4) Soladeck 0786 - $25. Also many Enphase trunk cables w/ connections. Sunnyside Solar Store, 499 W. Brattleboro, VT. (802) 280-7319. joe@sunnysidesolar.com • www.sunnysidesolar.com

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GUIDE TO ADVERTISERS

Ingredient of the Month

Invisible Cultural Perceptions and Primate Behavior

By Larry Plesent

The thing about ubiquitous invisible cultural perceptions is that they are, well, often invisible. I stumbled onto one of these last week when I saw a pop-news headline claiming once again that chimpanzees are our closest genetic relatives. This, in fact, is not exactly true.

According to a 2012 article by K. Pruf in Nature, "Two African apes are the closest living relatives of humans: the chimpanzee (Pan troglodytes) and the bonobo (Pan paniscus). Although they are similar in many respects, bonobos and chimpanzees differ strikingly in key social and sexual behavior, and for some of these traits they show more similarity with humans than with each other.

Further, whereas chimpanzees are widespread across equatorial Africa, bonobos live only south of the Congo River in the Democratic Republic of Congo. As a result of their relatively small and remote habitat, bonobos were the last ape species to be described and are the rarest of all apes in captivity. As a consequence, they have, until recently, been little studied. It is known that whereas DNA sequences in humans diverged from those in bonobos and chimpanzees five to seven million years ago, DNA sequences in bonobos diverged from those in chimpanzees around two million years ago. Bonobos are thus closely related to chimpanzees."

Chimpanzee. Image: Flickr

This is incredible stuff. Humans and chimps diverged five to seven million years ago from a common ancestor, and bonobos split off from chimps two million years ago. This makes us all very closely related along this multimillion year genetic tree. Somewhere back there is presumed a common ancestor of all three species which exhibited characteristics common to all (and to us).

Now here is where it gets crazy. Chimpanzees are an aggressive male-dominated territorial society. Bonobos on the other hand are the relatively carefree matriarchal led love-child hippies of the primate kingdom. Their inevitable response to societal stress within the troop is to party and males rarely bump chests to prove dominance.

According to that same Nature article, "Compared with chimpanzees, bonobos are playful throughout their lives and show intense sexual behavior that serves nonconceptive functions and often involves same-sex partners. Thus, chimpanzees and bonobos each possess certain characteristics that are more similar to human traits than they are to one another's."

OK, let's get this straight. According to this genetic analysis published in a respected journal, humans share a nearly equal genetic heritage with two very different groups exhibiting two very different lifestyles and responses resulting from their two-million-year-old ways of life. One group is aggressive and male-dominated. The other, passive, playful, sexy and female-dominated. Both sets of genetics are presumed to come from a common ancestor. Humans, it stands to reason, have an equal propensity to either way of life. This is important: we seem to have one tenth of 1% more chimp genes than bonobo genes.

Is it possible that our entire view of what it means to be human is weighted by that slight fraction of a percentage that brings us closer to chimps than bonobos? Is it possible that, if we leaned one-tenth of 1% towards the bonobo side, our life view and lifestyle and our relationship to the Earth itself would be very different?

The hippies had it right. Don't make war, have a party instead.

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

Latest Job Census on Vermont Trade Jobs

Cont'd from p.19

solar projects. Commensurate with job losses, Vermont saw it's first-ever decline in customer solar installations. Community solar projects which enable those who cannot host solar onsite due to renting, historic roofs, or shading slowed the most under the new rules.

"To grow local clean energy, we need clear and consistent rules. Changes in state policies significantly affect local solar jobs," added Campbell Andersen. "Given the tremendous local economic benefits and urgency of climate resilience, we can't afford to slow down on local solar energy."

The Vermont Solar Pathways study, supported by U.S. Department of Energy, found that if Vermont generated just 20% of our electricity from solar, we would create $8 Billion in net benefits for Vermonters. According to the 2017 Vermont Clean Energy Jobs report, undertaken annually by the Vermont Department of Public Service and released last year, about 87% of businesses in the clean energy sector are small business, with fewer than 24 employees, meaning these changes have tremendous effect on members of Vermont communities and result in loss of economic potential.

The Vermont solar tradesmen and women are resilient and adaptable, and many local businesses also offer total clean energy solutions including cold climate heat pumps, electric vehicle charging, and energy storage.

The National Solar Jobs Census is conducted by The Solar Foundation®, a national 501(c)(3) nonprofit organization whose mission is to accelerate adoption of the world's most abundant energy source. The full report can be at http://bit.ly/National-Solar_Job-Census ♻

Safely Unclog Drains Without Chemicals

By Roddy Scheer and Doug Moss, EarthTalk®

Chemical drain clog removers contain some pretty harmful stuff. The three main types available to consumers—caustic, oxidizing and acid—work by using harsh chemicals that heat up clogs to melt the congealed grease impeding the flow. All three are acutely toxic to humans and animals if swallowed, and coming into contact with them can burn your eyes, skin and mucous membranes. Even the fumes can cause respiratory distress. These chemicals can also explode inside your home's pipes—especially if inadvertently mixed with other chemicals or cleaners.

Unfortunately, you'll have to look hard to find drain clog removal formulations that don't come with big risks. The Environmental Working Group (EWG) Guide to Healthy Cleaning gives drain clog removers from the likes of Amway, Clorox, CVS, Drano, Liquid Plumr and Safeway an 'F' grade, given their toxicity to humans and animals and harshness to the environment. And don't be fooled by a product's branding, as an eco-friendly name can sometimes belie toxic ingredients. To wit, EWG also gave an 'F' to Up and Up Drain Pipe Opener and Earthworm Family-Safe Drain Cleaner for their environmental and health dangers.

EWG found that a few products—Biokleen Bac-Out Drain Care Gel, Drainbo The Natural Solution Natural Drain Cleaner, and Earth Friendly Products' Earth Enzymes Drain Opener—did a decent job unclogging drains without using especially toxic chemicals, but it's always better to try to avoid the problem in the first place.

In the kitchen, refrain from putting eggshells, coffee grounds, pasta, potato peels, rice, flour, produce stickers, paint and cleaning products down your sink drain, even if you have a garbage disposal. As for keeping grease out of the drain, try to scrape or mop it up with a paper towel and throw it away. Also, keeping your garbage disposal clean—pour a little dish detergent down the drain and run the disposal under cold water for a minute or two each night after doing the dishes—will also prevent back-ups.

Simple devices like the TubShroom can trap hair before it gets into your drain and causes a back-up. Courtesy Image.

As for the bathroom sink, shower or tub, hair (whether from dad's shaving or sister's styling) is likely the chief suspect in clogs. A hair catcher like the TubShroom (or SinkShroom or ShowerShroom) could help. This ingenious little mushroom-shaped device pops into the drain and attracts and coils hairs around itself before problems start. Pop it out every couple of weeks, peel off and dispose of the collected hair in the garbage, and start the process all over again.

A little preventive maintenance goes a long way to keep drains clear. Health and wellness site Mercola.com suggests filling sinks with a mix of white vinegar and warm water, then releasing the drain so this all-natural dynamic cleaning duo can do its work degreasing your outflow pipes. If the drain still runs slowly, pour in several tablespoons of baking soda followed by a white vinegar chaser.

Contacts HowStuffWorks' "How Drain Cleaners Work," home.howstuffworks.com/home-improvement/plumbing/drain-cleaner2.htm; TubShroom, tubshroom.com; Environmental Working Group's Guide to Healthy Cleaning, ewg.org/guides/cleaners; Mercola.com, mercola.com.

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Elmore Roots' Permaculture Know-How

The Sweetness of Having a Piece of Land to Grow Food

by David Fried

Painting by Gabriel Tempesta

Travelling around the east coast I notice that a lot of people live in apartment buildings. This conserves more open land, but I wonder if that open land can be farmed and if the people in the tall buildings still have a connection to it?

Those of us with even a small bit of land have a way to dip in to the soft earth and help things grow up from it. Today, I was speaking with a man who has an eight-foot-by-eight-foot backyard in Brooklyn who was excited when I told him that, if it received sunlight, he could grow some blueberry bushes or a pear tree there.

Squirrels, skunks and sparrows make it in small city spaces and so can plants. I have read that a fruit tree somehow distills the water rising in its sap to form its fruit, so even fruit grown along highways or inner cities is purified by the inner workings of a tree.

It is pretty standard for a home to be sold with a birch tree and a spruce tree and a few azalea bushes in front, and that is it. What if most homes came with a few plum trees or a tasty crabapple tree and a raised bed for a vegetable or herb garden? Is there a better way to increase the love of children growing up for the earth and the land around them than by letting them plant and harvest and taste and feel it?

We had two crabapple trees in my backyard growing up, and my dad would prune them, and from them, my mom baked fragrant apple pies .My mom had garden gloves with peas and carrots printed on them, and she grew these vegetables along the fence. One day, my brothers and I looked out our kitchen window while eating our breakfast and saw our neighbor's pet monkey up in these apple trees -you never know how exciting life can be when you live with fruit trees!

I was introduced as a "farmer in Vermont" at a gathering in New York City earlier this week. Many young people, students at New York University, gathered around me saying, "We want to be organic farmers. How do we do it?" I felt like a celebrity!

We who grow fruits and nuts and vegetables have a great legacy which we need to pass on to younger people. There is nothing as optimistic as planting a fruit or nut tree or a berry patch and a garden. It means we plan to be around to harvest from it, and it means we believe the world will still exist! It also gives us a chance to do something with our hands, with no phone in one of them. We get to whisper to the earth, and we get to hear the earth whisper back -- in flowers!

Remember what Joni Mitchell sang to us as the 60s were going out? "And we've got to get ourselves back to the garden." See you there soon..

David Fried is the grower/poet of Elmore Roots fruit tree nursery in Elmore, Vermont. ♻

Monadnock Food Co-op Goes 100% Renewable for 2018!

In addition to the Community Supported Solar array on their roof, a recent LED lighting retrofit, and use of "Polar Power" to pump cold outside air into their coolers, Monadnock Food Co-op has also signed a contract with Constellation New Energy to source their additional electricity from renewable sources for the 2018 calendar year, and beyond.

"We recognize that climate change is a serious threat to our suppliers, both worldwide and at home. From the floods and landslides that plagued organic banana farmers in Peru this spring, to the wildfires affecting California vineyards, and the drought that hit our state's dairy farmers especially hard last year, the increasingly volatile climate that affects our global community is something our cooperative strives to avoid," said Michael Faber, General Manager of Monadnock Food Co-op. "I am so proud that despite almost doubling our staff and sales since opening five years ago, we have been able to reduce our overall energy consumption over the past two years. We are also excited to be able to support the generation of wind energy to cover the electricity that is necessary to power our store."

The Co-op's agreement with Constellation New Energy allows the Co-op to buy Renewable Energy Credits (RECs) from wind power for 100% of their estimated electricity usage beyond that produced by the rooftop solar array. For every unit of renewable electricity generated through wind energy technology, an equivalent amount of RECs is produced. The purchase of RECs supports renewable wind electricity generation and reduces conventional electricity generation in the region.

"As renewable energy becomes increasingly more price-competitive, we hope many other businesses in our community will join our co-op in investing in initiatives like the Community Supported Solar Project with Monadnock Sustainability Network, and in sourcing renewable power to meet their needs," said Emerald Levick, Marketing Manager for Monadnock Food Co-op. "Working for the safety, security, and resilience of our community in the face of climate change will take every one of us, contributing in every way we can." ♻

Recycle Crayons into Reusable Energy

Monadnock Food Co-op & Keene Middle School Recycling Partnership

A group of Keene Middle School 6th graders excited about the Crayola ColorCycle program.

The Monadnock Food Co-op and the Keene Middle School (KMS), both located in Keene, NH, have partnered to reduce marker waste. The two organizations are working together, through the Crayola ColorCycle program, to collect coloring and permanent markers, dry-erase makers, and highlighters in order to divert them from local landfills. Crayola collects these markers from schools across the country and converts them into reusable energy.

The Co-op's Green Team has been working with Betsy Stacey, KMS Extensions Teacher, and the Student Council to implement the program in the school and the store. There is more, as this project goes beyond just recycling; the two organizations are providing students with educational opportunities by teaching about recycling and engaging them in store tours.

"This program offers a unique opportunity to make an impact within our community while teaching students the importance of waste diversion" says Laura Carbonneau, Green Team member and Events & Marketing Associate at the Co-op. "Understanding the life cycle of the products we use on a daily basis gives us all a stronger foundation on which we can implement positive change."

The Monadnock Food Co-op is a community-owned food store offering a diverse selection of local, organic and natural foods to the Monadnock Region. The co-op is located at 34 Cypress Street in Keene, right off of Main Street via Eagle Court: www.monadnockfood.coop. ♻

Improving the Air Quality in Your Home *Without Breaking the Bank*

EarthTalk® — From the Editors of E -The Environmental Magazine

The key to a healthy indoor environment is clean air, but many of the finishes and furniture in a typical home or office off-gas pollutants that can compromise air quality. While opening a window might help, it also could make matters worse by introducing auto exhaust and other noxious emissions in. So, what's a clean air lover to do about keeping the indoor environment safe?

For starters, it can't hurt to change the filters on your furnace and air conditioner(s) on a regular, scheduled basis. Manufacturers recommend changing out furnace filters every three months, but that interval may vary depending on square footage of the heated space and other factors. (When you install a new filter, write the date on it when it should be changed to keep yourself honest.) Also, getting your HVAC air ducts cleaned once every few years—or more frequently if you have pets or lots of people using the space in question.

Another way to help filter your indoor air is the all-natural way: with house plants. While humans have always had a special relationship with the plants around them, it wasn't until NASA published research in the 1980s that we knew just what an important role house plants could play in ridding indoor environments of noxious chemical pollutants. Plants scrub particulates from the air while taking in carbon dioxide and processing it into oxygen, thereby creating more clean air for us to breathe. Garden mums, spider plants, dracaenas, ficus, peace lilies, Boston ferns, snake plants and bamboo palms are great choices given their especially powerful air purifying abilities.

Yet another relatively easy fix would be to purchase an air purifier that plugs into the wall and uses carbon filtration or other methods for filtering contaminants out of the indoor environment. The Coway Mighty and Winix 5500-2 share top rankings from leading consumer review service, Wirecutter, while the Dyson Pure Hot+Cool Link gets a kudos for great air cleaning with style.

Getting a few houseplants is one way to start cleaning up the air quality inside your home. Credit: Stephanie Vacher, FlickrCC.

If you really want to go all out, think about repainting interior walls with paint formulations that use little or no volatile organic chemicals (VOCs) that have been linked to respiratory problems, headaches, nausea, dizziness and fatigue, among other health worries. AFM Safecoat is the industry leader in low- and no-VOC paints and finishes, but the big players like coatings manufacturers Sherwin-Williams and Benjamin Moore now also have more healthful formulations for a quickly increasing number of eco-conscious home improvement customers.

Another easy albeit more costly way to green up your indoor environment would be to get rid of those old couches, mattresses and other furniture which were required by law to contain flame retardant chemicals before we knew how harmful they could be to our indoor environment and health. Now that California has mandated that new furniture products cannot contain these noxious chemicals, more and more manufacturers (including Ikea and Pottery Barn) are starting to phase them out, so it's a great time to replace that old mattress with a new one that won't off-gas carcinogens every time you plop down onto it.

Contacts: Coway, coway.com/Product/Detail?prod_disp_no=47; Winix, winix-america.com/product/5500-2; Dyson, http://www.dyson.com/air-treatment/purifiers/dyson-pure-hot-cool-link-evo/overview.aspx; NASA's "Indoor Landscape Plants for Indoor Air Pollution Abatement," https://goo.gl/j7WzPU; AFM Safecoat, www.afmsafecoat.com.

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Portland, Maine Unanimously Bans Toxic Pesticides

Portland is now the biggest city in the country to ban the use of toxic pesticides on public AND private lands.

On a snowy day at the beginning of this year, folks in Portland, Maine were thinking summer — a pesticide-free one!

On January 3, 2018, the Portland City Council unanimously passed one of the nation's strongest ordinances prohibiting toxic chemical pesticides on all public and private property. Starting this summer, Portland will practice city-wide organic land-care in a huge step forward towards a healthy Maine. Congratulations to Avery, Maggie, and other members of the Portland Protectors who made it happen!

A crowd gathered at the Fort Allen Park gazebo for the summer concert series. Credit: Corey Templeton/Flickr.

Toxics Action Center Campaigns worked with the Portland Protectors for nearly two years to win safeguards against dangerous pesticides throughout the city. Toxic pesticides have been linked to asthma, learning disabilities, birth defects and cancer, and they also threaten our water and the pollinators we need to keep our food system healthy. In the last two decades, Maine had seen a seven-fold increase in lawn-care pesticides.

With this ordinance, the Portland Protectors took a bold step towards reversing this dangerous trend. Thanks to the hard work of grassroots leaders, city councilors voted 9-0 to ban chemical pesticides starting this summer and created an advisory group to educate the city on healthy, organic land use practices.

Last year in neighboring South Portland, community groups like Protect South Portland passed a similar ordinance to ban dangerous pesticides on public and private land. The ground-breaking organic land care ordinance was one of the first of its kind and community leaders hoped that it would kick off a trend in Maine and beyond -- and it did. Portland is now the biggest city in the country to ban the use of toxic pesticides on public and private lands.

Sylvia Broude, the Executive Director of Toxics Action Center Campaigns said, "With such dedicated activists working for a pesticide-free Maine, and your support, we know this victory won't be our last. This is what bottom-up change looks like!"

Portland's example is an amazing one that the staff at Green Energy Times hopes to see followed throughout the northeast and well-beyond. The Toxics Action Center can help. Their website is: toxicsaction.org. Contact them at info@toxicsaction.org or 617-292-4821. ♻

Going for Green at This Year's Olympics

PyeongChang sets the stage for Energy Efficiency & more!

By Dawn Selak

Later this week, athletes proudly wearing their countries' colors will fill the winter sports arenas of PyeongChang, South Korea, as they compete in the 2018 Olympic Winter Games. But one color---green---will be present throughout the games, thanks to the PyeongChang Organizing Committee's (POCOG) sustainability and energy efficiency efforts.

These efforts---including a high-speed railway, electric vehicles, and efficient buildings---explain why the Nigerian women's bobsled team won't be the only team making history at this Olympics. PyeongChang 2018 is the first Winter Olympic Games to receive the ISO 20121 certification, a sustainability standard for entire events. It is only the third Olympic Games to be certified, along with the London 2012 and Rio 2016 Summer Olympics.

New railway saves energy

The South Korean government and its citizens have long prioritized public transportation. Seoul's subway is the third-busiest metro system in the world---touted as among the best in the world, as well. So it's no surprise that public transit is a key part of the POCOG's sustainability plan for the Winter Games.

With both the Games and overall accessibility in mind, the Wonju-Gangneung High-Speed Railway was constructed to connect the Incheon International Airport, located outside Seoul, to PyeongChang and nearby Gangneung. The railway is energy-efficient, using less energy and boasting a carbon footprint one-eighth that of gasoline vehicles. It is also time-efficient, cutting travel time between Seoul and Gangneung to less than two hours, as compared to six hours on the Mugunghwa train. In fact, the newly constructed railway is expected to prevent more than 6,000 metric tons of greenhouse gas emissions if 420,000 visitors choose the express railway over personal vehicles.

Locally, electric vehicles will be used to transport participants and visitors, while also cutting energy use and carbon emissions. The Korea Electric Power Corporation agreed to provide 150 electric vehicles and 24 additional charging stations to be used during the Games.

International collaboration brings comfort and efficiency

Just as the Olympic Games bring together athletes and visitors from around the world, POCOG is working with international partners to make its sustainability efforts a success.

Using energy-efficient materials, POCOG constructed a variety of new buildings needed for the Games. Many of the buildings utilize cutting-edge materials which insulate facilities ranging from the modular houses that will accommodate event drivers, to the Olympic Plaza and the International Broadcast Centre. In all those buildings, the insulating panels will optimize energy use and cut heating costs by keeping warm air in, and cold air and moisture out.

In some instances insulation will increase energy efficiency by keeping a building cold. The Olympic Sliding Centre uses a polyurethane spray foam to ensure the luge, bobsled, and skeleton track stays frozen. The venue also has a variety of other energy-efficient features, including LED track lighting, that enabled it to be one of six G-SEED (Green Standard for Energy and Environmental Design) Certified facilities built for the Games.

Going for the gold (or green)

The Olympic Committee's measures reflect South Korea's commitment to sustainability and energy efficiency. In ACEEE's 2016 International Energy Efficiency Scorecard, South Korea tied with the United States for the eighth spot. The nation also ranked sixth in the transportation section, setting it apart from the United States, where transportation is currently the largest source of carbon dioxide emissions. On the other hand, South Korea ranked thirteenth in the buildings section, so it is good to see POCOG going the extra mile on building efficiency.

We at ACEEE welcome the efficiency efforts of the Games and the country as a whole. We will be updating our rankings of South Korea and other countries with the June release of our 2018 International Energy Efficiency Scorecard. The scorecard will be material for our upcoming International Symposium. Stay tuned for details and have fun watching the Olympics.

Dawn Selak is the communications manager at ACEEE. ACEEE, The American Council for an Energy-Efficient Economy, acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. For information about ACEEE and its programs, publications, and conferences, visit aceee.org. ♻

Sustainable Business 2018

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of pumping oil. This includes Cameron Parish, which had the highest percentage of Trump voters of any county in the U.S.

3. Renewable energy has had its own branch of financing under development. Green financing specializes in projects that ordinary investors cannot accurately assess. This means that evaluations of projects for investors are improving. It also means that increasing amounts of funding are appearing at declining interest rates.
4. Energy storage technology is improving rapidly and costs of storage are declining accordingly. The effect of this on the market can be seen in the responses to Xcel's recent requests for bids on solar power, wind power, and storage in various combinations. The median price of bids for wind plus batteries was 2.1¢ per kilowatt-hour, precisely half of the lowest price available for electricity from combined cycle natural gas.
5. In the very near future, as we move to deal with climate change, we will need to move away from fossil fuels to the point that nearly everything is electrically powered. Though it is not happening in the U.S. yet, in some places, such as Norway, even short range air transportation is expected to be powered by electricity.
6. Though it may sound unbelievable, fully-automated electric vehicles could soon be delivering goods and transporting people through much of the U.S. Tony Seba, a recognized expert in disruptive technologies, has said he expects that car-owning residents of New York could get service from automated vehicles they call with smart phones that is as good as what they get with their own cars, and they could save 90% of the cost in the process. We might envision the same being true in rural areas, if we allow for having to call for the cars ten minutes before they are needed. How many of us would prefer to keep 90% of the money we spend on cars?
7. Artificial Intelligence is expected to have profound effects on the electric grid. We can also expect it to have effects on all other uses of fossil fuels. The effects could be found in everything from heating our homes to mowing our lawns.
8. As renewable energy sources are established, there will be new opportunities to use power at times when no one wants it. This means that a whole set of synthetic fuels and chemicals could become available, of which hydrogen is a good example. When it is burned, the only by-product is water.
9. Our health can be expected to improve with the reduction in pollution that can be expected with reduced use of fossil fuels. With this will naturally come reduced costs for health care and insurance.

There may be good news after all. For those who wish to learn more, we suggest reading "2018 State of Green Business," an 80-page report from GreenBiz.com (http://bit.ly/state-of-green-biz-2018). ♻

The 2018 Sustainability Super Bowl

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on-site production of green energy and their green power purchasing agreement.

So, we know the Eagles won Super Bowl LII, but who wins the 2018 Sustainability Super Bowl?

The scoreboard says…it's the Philadelphia Eagles again! As it turns out, they are as green as their uniforms!

Image: Lorie Shaull/Flickr

Sustainability at U.S. Bank Stadium

As 103.4 million Super Bowl viewers around the country now know, U.S. Bank Stadium in Minneapolis looks quite futuristic—what they may not know is that it is also one of the most state-of-the-art, sustainable sports facilities in the country.

As reported on the Minnesota Vikings' official website, at its opening in 2016, U.S. Bank Stadium became the first NFL venue to be built with an advanced LED lighting system that allows for instant on-and-off capabilities while using 75% less energy compared to metal halide lights.

The LED lighting system is impressive; however, the Vikings plan on minimizing its use by taking advantage of the immense amount of natural lighting that the facility's extraordinary roof provides. More than half of U.S. Bank Stadium's roof covering is made of a clear, plastic-like material called ethylene tetrafluoroethylene (ETFE), which facilitates the use of sunlight as a free year-round source of natural heat and light for the stadium. By using a lightweight building material such as ETFE instead of conventional steel, the Vikings were able to significantly reduce the carbon footprint of the stadium's construction process.

Generally, stadiums built in areas with snowy winters require a lot of steel to support their roofs, however, the domed shape of U.S. Bank Stadium's roof made it possible to forgo an estimated 2,000 tons of steel. The steep, asymmetrical design allows snow to quickly roll down the roof and into a giant, heated snow gutter that brings the water straight to the stadium's storm water control system.

In addition to this, low-flow plumbing technology is expected to reduce U.S. Bank Stadium's water usage by 5.67 million gallons annually.

PyeongChang 2018 Organizers Hoping To Get Medal in Sustainability

With host cities building expansive new facilities and athletic teams and spectators travelling from around the globe in order to attend, the Olympic Games typically result in a very large carbon footprint. With this in mind, the organizers of this month's Winter Olympics in PyeongChang have worked to minimize the international celebration's toll on the environment.

"Since we won the bid to host the Games, sustainability and the environment have been at the heart of our plans and procedures," said Teachul Rhyu, PyeongChang Organizing Committee for the 2018 Olympic and Paralympic Winter Games (POCOG) Director General of Environment. "Our venues and infrastructure have all been completed to the necessary standards and we will continue to focus on our sustainability goals throughout the Games and beyond to leave the legacy that the Games deserve."

POCOG has also launched a fundraising website, CarbonFund2018.com, which allows Olympic participants and visitors to make donations to purchase internationally-traded Certified Emission Reductions (CERs) to help offset the significant carbon emissions associated with the Games. Olympic guests will also be able to make donations in-person at a donation center at the Olympic Park in Gangneung.

Sophie Caldwell, Shaftsbury, VT. Wikipedia.

Reducing the Olympics carbon emissions is a goal shared by the International Olympic Committee and athletes alike. One such athlete is Andy Newell, one of many Vermonters who will be representing Team USA in Pyeongchang as a member of the Olympic cross-country ski team.

Let the Games begin! Team USA at PyeongChang 2018. Image: http://bit.ly/PeyongChang2018-TeamUSA

"Embracing sustainability is something we all need to see as important if we value the future of winter sports," Newell told G.E.T. in a recent interview. "In my opinion, it's all about finding the balance between reducing our footprint (as winter athletes) and consuming less but not neglecting an industry than needs innovation."

Newell says that ski resorts could, in theory, stop making snow and stop grooming the trails completely in order to significantly reduce the industry's carbon footprint but snow sports as a whole would suffer due to the subsequent lack of accessibility and interest. According to Newell, one of the best ways for winter athletes to enact change is by using their platform to spread environmental awareness to young people.

"I often visit high schools on behalf of Protect Our Winters," Newell said. "These kids are the ones who will be voting in just a few years and if I can connect with them, it has the potential to have the biggest impact and create the cultural shift towards sustainability that we so desperately need in the U.S."

In addition to being a celebration of skill and culture, hopefully this year's Winter Olympics will serve as a reminder to viewers worldwide that, although our athletes compete against international athletes, we are really all on the same team. Regardless of nationality, it's up to all of us to support one another as we develop and implement solutions, both creative and commonsense, for the hefty environmental challenges we as a species face in professional sports and beyond.

Andy Newell lives in Shaftsbury, VT. This is his fourth Olympic Games, winning bronze in the 2014 Sochi Games. Courtesy image: Andy Newell.

Best of luck to all members of Team USA!

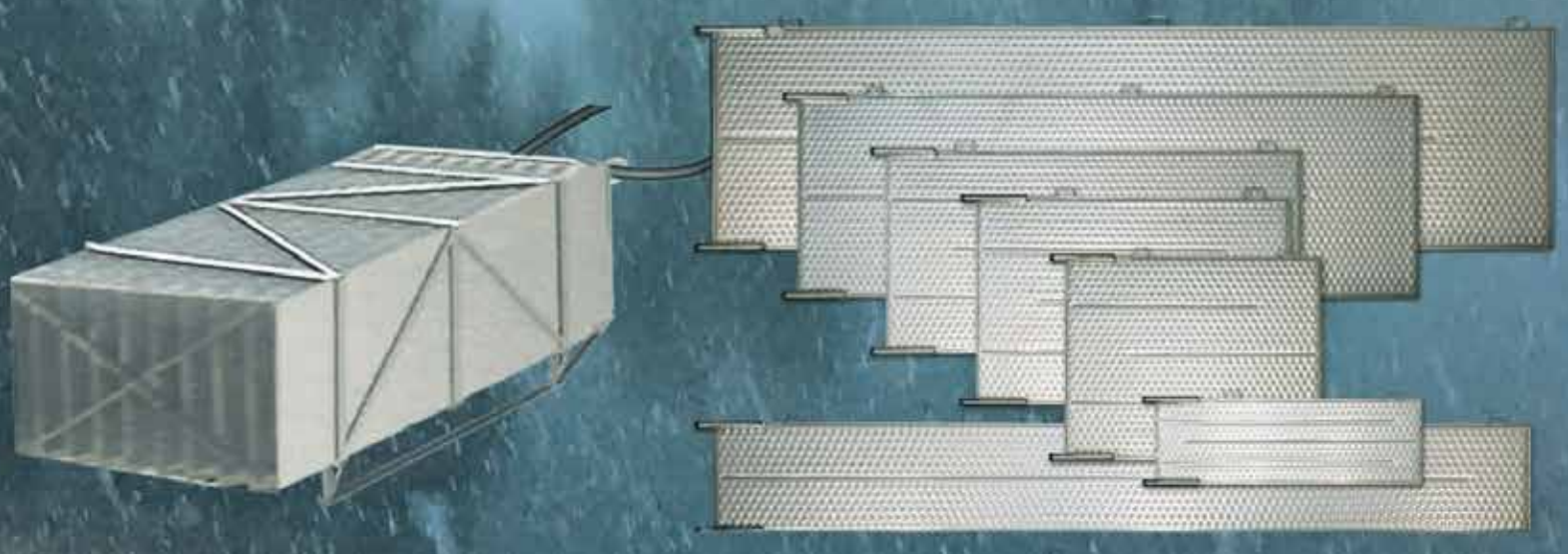
To learn more about sustainability at the Olympics, check out "Going for Green at the Olympics" on page 38.

For the complete list of winter athletes aligned with Protect Our Winters, visit www.protectourwinters.org/riders-alliance.

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

Baby, It's Cold Outside!

But there is heat in the water!



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