SOLAR TODAY

An *American Solar Energy Society* Magazine
Fact-Based Reporting on Achieving a 100% Renewable Energy Society

Fall 2020
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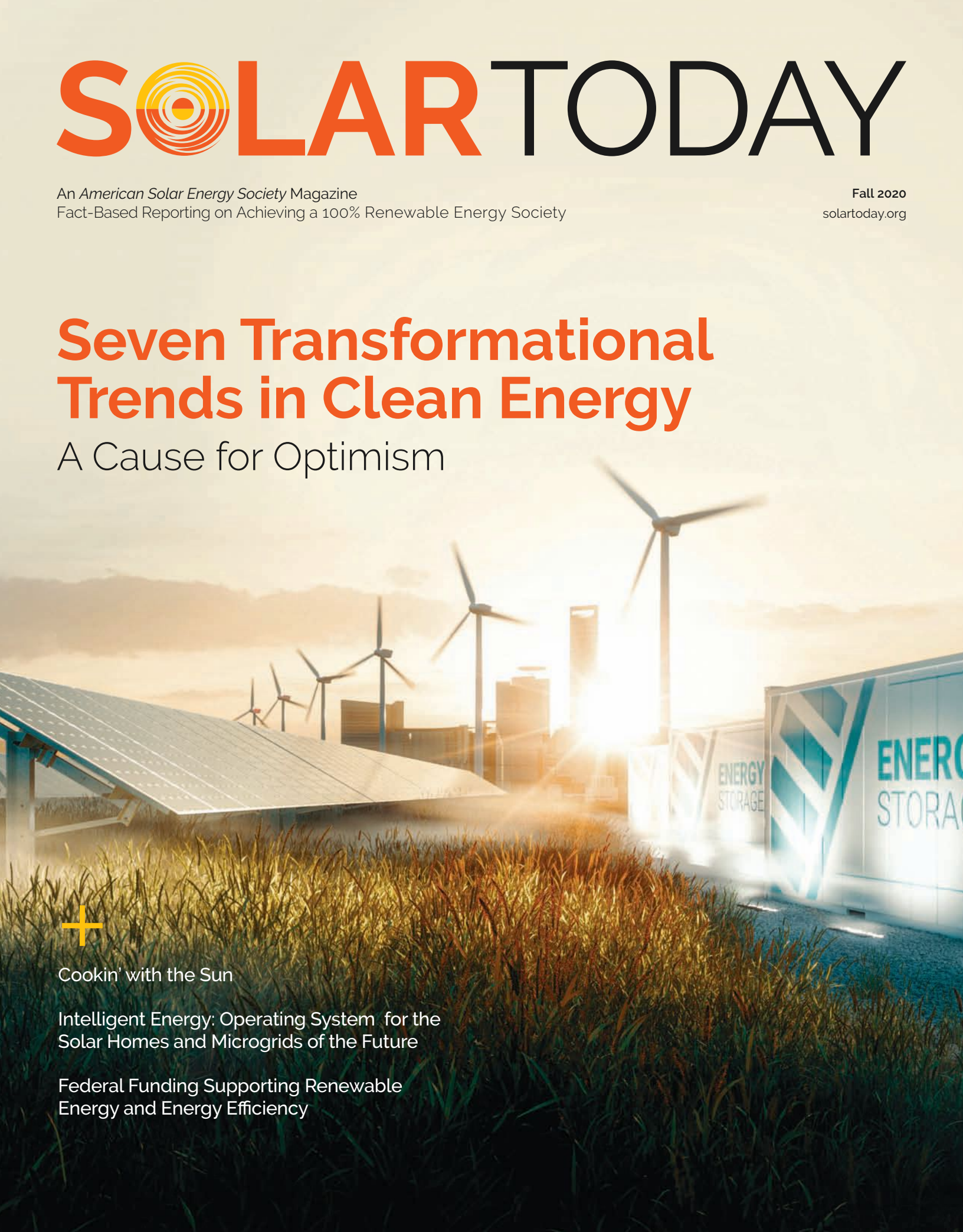
Seven Transformational Trends in Clean Energy

A Cause for Optimism



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Cookin' with the Sun

Intelligent Energy: Operating System for the Solar Homes and Microgrids of the Future

Federal Funding Supporting Renewable Energy and Energy Efficiency

ASES SOLAR 2021

Empowering a Sustainable Future

50th Annual National Solar Conference

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In Every Issue

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SOLAR TODAY

Environmental Statement

Solar Today is printed with vegetable ink on paper containing 100% post-consumer waste. The paper is produced at a biomass-powered mill. This issue saves:

Trees	182
Energy	121 million Btu
Water	27,574 gallons
Greenhouse Gases	8.9 tons
Solid Waste	7.2 tons

Rise Up, Harvest Sun!

To our friends up and down the west coast, our hearts go out to you.

Just when we thought 2020 couldn't get any worse, record-setting wildfires have burned over 2.3 million acres across California and are now scorching the Northwest and West. We are hearing terms like "apocalyptic" and "nuclear winter" describing the smoke blotting out the sun in the San Francisco area as ash descends from the sky. Temperatures reached 130 in Death Valley — the hottest recorded temperature on the planet in more than a century.

The new normal is becoming all too normal. Record heat for several days across parts of California in August strained the power grid so much that it started rationing electricity, for the first time in almost 20 years. This issue of *Solar Today* focuses on microgrids and innovation in electrification. With these historic fires and heatwaves, as well as flooding and devastation from hurricanes, the heat is on, and all while the grid faces increasing demand from the electrification of cars, buses, businesses, and homes.

Now is a better time than ever to #builditbackbetter: smart buildings, smart cities, smart energy. This technology is not that new, but now it is better and cheaper than ever. A new electrical grid infrastructure is not a complete overhaul—the existing grid can be used as a giant battery. And a distributed army of solar+storage prosumers can support their own neighborhood blocks. With an evolving energy resource mix, weather forecasts, and powerful new hardware and software communications systems, we get a glimpse into the future of the electrical grid. Electricity customers and solar homes are transforming into microgrid managers. Join ASES at our next conference, **SOLAR 2021: Empowering a Sustainable Future**, to discuss these and more innovations. SOLAR 2021 will be held August 3-6, 2021, at the University of Colorado/ Boulder. The Call for Participation is now open at **ases.org/conference.**

It's election time, and the huge spending planned by governments in response to the devastation must support green initiatives rather than fossil fuels. Fall is a time of harvest. Harvest moon, sure, but let's harvest the sun! Harvest those electrons, and hey while we're at it let's use them to make hydrogen fuel! Harvesting the sun is the most regenerative form of "agriculture." So as the sun heads south and the shadows grow longer, we can tilt our panels up to get the most for our money. Going solar is no longer something that you do just for the planet. It is a good financial move. That's a fact to be celebrated. We've been hit by so much tragedy this year, we could use a cause for celebration.

Our **National Solar Tour** is completely virtual this year to keep us in the safe zone. Although so much of our lives are "virtual" now, remember to say hello to your neighbors and point out your solar system as they pass by any time of year.

Carly Rixham,
ASES Executive Director

SOLARTODAY
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AMERICAN SOLAR ENERGY SOCIETY

Renewable Energy Dominates New U.S. Electrical Generating Capacity

By Ken Bossong, *SUN DAY Campaign*

According to a review by the SUN DAY Campaign of data just released by the Federal Energy Regulatory Commission (FERC), renewable energy sources (i.e., biomass, geothermal, hydropower, solar, wind) dominated new U.S. electrical generating capacity additions in the first half of 2020. Combined, they accounted for 57.14% - or 7,859 megawatts (MW) - of the 13,753 MW of new capacity added during the first six months of the year.

FERC's latest monthly "Energy Infrastructure Update" report (with data through June 30, 2020) also reveals that natural gas accounted for 42.67% (5,869 MW) of the total, with very small contributions by coal (20 MW) and "other" sources (5 MW) providing the balance. There have been no new capacity additions by oil, nuclear power, or geothermal energy since the beginning of the year.

Moreover, all of the 1,013 MW of new generating capacity added in just the month of June was provided by solar (609 MW), wind (380 MW), and hydropower (24 MW). These include the 200.1 MW Reading Wind Project in Lyon, KS and the 179.8 MW RTS 2 Wind Project in MCulloch County, TX as well as the 300.0 MW Prospero Solar Project in Andrews County, TX and the 121.9 MW Wagyu Solar Project in Brazoria County, TX.

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Over the past half-decade, wind's share of the nation's generating capacity has expanded by nearly 60% while that of solar is now almost four times greater.

Renewable energy sources now account for 23.04% of the nation's total available installed generating capacity and continue to expand their lead over coal (20.19%). [1] The generating capacity of just wind and solar is now at 13.08% of the nation's total, and that does not include distributed (e.g., rooftop) solar. [2]

For perspective, five years ago, FERC reported that total installed renewable energy generating capacity was 17.27% of the nation's total with wind at 5.84% (now 9.13%) and solar at 1.08% (now 3.95%). Thus, over the past half-decade, wind's share of the nation's generating capacity has expanded by nearly 60% while that of solar is now almost four times greater.

By comparison, in June 2015, coal's

FIRST HALF OF 2020:

- Renewables are 57.1% of new U.S. generating capacity
- Renewables are sole source of new capacity in June

share was 26.83% (now 20.19%), nuclear was 9.20% (now 8.68%), and oil was 3.87% (now 3.29%). Only natural gas has shown any growth among non-renewable sources - expanding modestly from a 42.66% share five years ago to 44.63% today.

In addition, FERC data suggest that renewables' share of generating capacity is on track to increase significantly over the next three years (i.e., by June 2023). "High probability" generation capacity additions for wind, minus anticipated retirements, reflect a projected net increase of 27,226 MW while solar is foreseen growing by 26,748 MW. By comparison, net growth for natural gas will be only 19,897 MW.

OVER THE NEXT THREE YEARS:

- Renewables will add over 56,000 MW of new capacity
- Wind and solar will each provide a third more new capacity than natural gas

Thus, wind and solar are forecast to each provide at least a third more new generating capacity than natural gas over the next three years.

While hydropower, geothermal, and biomass also are all projected to experience net growth (2,056 MW, 178 MW, and 113 MW respectively), the generating capacity of coal and oil are projected to plummet - by 22,398 MW and 4,359 MW respectively. In fact, FERC reports no new coal capacity in the pipeline over the next three years and just 4 MW of new oil-based capacity. Nuclear power is forecast to remain essentially unchanged - adding a net of just 2 MW. In total, the mix of all renewables will add more than 56.3 gigawatts (GW) of net new generating capacity to the nation's total by June 2023, while the net new capacity projected to be added by natural gas, coal, oil, and nuclear power combined will actually drop by 6.9 GW .

If these numbers hold, over the next three years, renewable energy generating capacity should account for comfortably more than a quarter of the nation's total available installed generating capacity.

In fact, renewables' share could be even higher. Over the past one and one-half years, FERC has been regularly increasing its renewable energy projections in its monthly "Infrastructure" reports. For example, six months ago in its December 2019 report, FERC forecast net growth over the next three years of 48,254 MW for renewable energy sources - i.e., 8,067 MW less than its latest projection.

"While the global coronavirus crisis has slowed their rate of growth, renewables - especially wind and solar - continue to expand their share of the nation's electricity generating capacity," noted Ken Bossong, Executive Director of the SUN DAY Campaign. "And as prices for renewably-generated electricity and energy storage fall ever-lower, that growth trend seems nearly certain to accelerate." ■

About SUN DAY Campaign

The SUN DAY Campaign is a non-profit research and educational organization founded in 1992 to support a rapid transition to 100% reliance on sustainable energy technologies as a cost-effective alternative to nuclear power and fossil fuels.

Resources

[1] Capacity is not the same as actual generation. Capacity factors for nuclear power and fossil fuels tend to be higher than those for most renewables. For example, in 2019, the U.S. Energy Information Administration (EIA) reported that renewables accounted for 18.2% of the nation's total electrical generation - that is, somewhat less than was their share of installed generating capacity (22.1%) for the same period. Conversely, coal's share of generating capacity in 2019 was 20.9% while its share of electrical generation was 23.3%.

[2] FERC generally reports data only for utility-scale facilities (i.e., those rated 1-MW or greater) and therefore its data do not reflect the capacity of distributed renewables, notably rooftop solar PV which - according to the EIA - accounts for nearly a third of the nation's electrical generation by solar. That would suggest that the total of distributed and utility-scale solar capacity combined may be as much as 50% higher than the solar capacity of 3.95% reported by FERC—i.e., closer to 6%.

FERC's 7-page "Energy Infrastructure Update for June 2020": https://bit.ly/3gpGZm0.

The U.S. Energy Information Administration "Electric Power Monthly" report: https://bit.ly/3hkgwaq

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SEVEN TRANSFORMATIONAL TRENDS IN CLEAN ENERGY

A Cause for Optimism

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By Scott Sklar

Huge trends in the global marketplace are driving how we use energy, communicate, interface, and transport ourselves. These trends are merging so that it is difficult to view them individually; they now appear as intertwined. I will list these trends with supporting information from a number of sources to paint the picture.

1. Transactional Energy, Blockchain Uncover Hidden Value

There are over 70 software solutions for power plant monitoring. Most Operations and Maintenance (O&M) providers use a mixed portfolio of software applications to manage commercial and industrial (C&I) systems, including wind farms and solar parks. As information and operational technologies converge, intelligent building solutions that provide actionable insight using data-driven tools are gaining traction worldwide. Because the intelligent building is fundamentally reliant on creating a data-rich environment, sensors play a crucial role in facilitating these solutions. Sensors capture, communicate, and analyze energy and operational data. This data is useful information to

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We are witnessing transformative technological change moving at warp speed in the midst of two global emergencies – and climate change and the COVID-19 pandemic.

direct fundamental changes in operations that result in energy efficiency improvements with substantial cost savings.

The infrastructure that gathers and transmits data to deliver actionable insight is part of what's referred to as the Internet of Things (IoT). Wireless sensors can help deliver holistic and comprehensive insight into operations across systems within a secure, scalable, and open infrastructure. Wireless connectivity provides greater flexibility for sensors and amplify the benefits of intelligent building solutions. Larger networks can increase the number of connected devices, enabling more granular control over building systems. According to Navigant Research, global wireless sensor revenue is expected to grow from $188 million in 2016 to $745 million in 2025, a 16.5% compound annual growth rate (CAGR).[1]

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Demonstration microgrid at Joint Base San Antonio.

2. Transactional Energy, Blockchain Uncover Hidden Value

A complex technology with a simple name, blockchain is a transaction-tracking technology that is the underpinning behind cryptocurrency such as Bitcoin and Etherium. When a block stores new data it is added to the blockchain. Multiple blocks strung together enable the tracking and monetizing of energy loads, utility bills, and other energy savings and energy producing options such as on-site renewables. According to recent research from Monash University in Australia, as blockchain industries mature, they allow utility and microgrid market operators to enable "transactive energy" to control the flow of power in the electrical grid, building, or facility, using economic or market-based constructs. Transactive energy can benefit both distributed energy resources (DER) operators and the central grid. It encourages "dynamic demand-side energy activities based on economic incentives and ensures that the economic signals are in line with operational goals to ensure system reliability," according to their research. DER operators are able to tap into new revenue streams by selling services to the grid, abd the grid gains greater stabilization from the services.[2]

3. Energy Storage Comes of Age

Energy storage allows energy to be utilized when it is most cost-effective or most urgent. There are a host of options which include batteries, compressed air and storage, pumped hydro, flywheels, weights, molten salts and ice, and even hydrogen. All are susbstantially decreasing in cost and are becoming more sophisticated in their interaction with utility grids, microgrids, buildings, and other infrastructure.

Bloomberg New Energy Finance reported last year that storage investments are booming as battery costs are set to halve in the next decade. They forecast energy storage installations around the world to multiply exponentially, from a modest 9 GW of energy and 17 GWh of power deployed as of 2018 to 1,095 GW/2,850 GWh by 2040. They report, "This 122-fold boom of stationary energy storage over the next two decades will require $662 billion of investment and will be made possible by further sharp declines in the cost of lithium-ion batteries, on top of an 85% reduction in the 2010-18 period."[3]

Although Bloomberg's forecast excludes pumped hydro energy storage, CleanTechnica reported that pumped hydro energy is storage poised for "global domination."[4] Researchers at Australian National University have identified 530,000 potential sites for pumped hydro, suggesting that a massive amount of energy storage capacity is already close at hand. The National Hydropower Association notes that the U.S. has more than 20 GW of

pumped storage capacity today, with facilities in every region of the country. Developers have proposed an additional 31 GW, primarily in the West, to support an increasing amount of variable generation that is coming online. New battery materials are also rushing into the global markets, as well as compressed air and liquid storage, flywheels, gravity storage, and hydrogen.

4. Microgrids and Hybrid Energy Systems: The Start of the Self-Healing Grid

Technologies and software allow electric grids to stabilize into discrete areas so that when there is a major failure, the electric grid itself can shed the areas impacted and sustain itself. Within the failing grid areas, microgrids are employed which can passively take over to further power critical functions.

The communications network composed of fiber optics, satellites, and cellular towers have now become self-healing grids – when a cell tower goes down, the towers triangulate and take over the loss. Smart data centers also have this self-healing capacity. As data centers go down, others compensate for the loss, and the internet remains operational. The global electric grids are also moving towards self-healing grids with advanced sensors and controls. An electric grid will be able to segment with sectionalizers and reclosers. Within those grid segments, battery storage littered throughout and microgrids are able to passively separate and power buildings or neighborhoods. And when all is better, the system can reconnect and operate as normal. This trend is unstoppable, and will significantly add to resiliency, reliability, and higher electric power quality (no surges, sags or transients, all of which ruin digital equipment), while lowering costs, freshwater use, pollution and greenhouse gas emissions.

Wood Mackenzie's newest report, *US microgrid forecast H1 2020: Coronavirus delays projects and impacts origination*, shows that 546 microgrids were installed in the United States during 2019, more than any other year. Three organizations - PowerSecure, Enchanted Rock and The American Red Cross – installed a combined 67% of these projects. Of these, the Red Cross was the only to integrate energy storage into their projects, pairing them with solar at non-residential locations. Last year saw nearly 50% growth in the number of microgrids. The share of renewable microgrid projects is expected to rise, with WoodMac anticipating solar, wind, hydropower and energy storage accounting for 35% of installed capacity annually by 2025.

A 2019 World Bank report says solar+storage is fueling a global mini-grid surge.[5] They report that "plummeting solar+storage costs could help electrify millions worldwide by facilitating a ten-fold explosion of mini-grid systems." The 19,000 mostly hydro- and diesel-based mini-grids that power 47 million people today could boom to 210,000 systems powering 490 million by 2030. The report said most new mini-grids will feature a mix of photovoltaics (PV) and small wind, with batteries, adding that the 10-15 GW of solar and 50-110 GWh of mostly lithium-ion batteries expected by 2030, would bring 1.5 billion tons of CO_2 savings. Mini-grids, unlike microgrids, are not connected to the larger macrogrid.

A 2020 Lawrence Berkeley National Laboratory data compilation maps existing hybrid and co-located plants across the U.S. while also synthesizing data from generation interconnection queues to illustrate developer interest in the next wave of plants. There are at least 125 co-located hybrid plants (>1 MW) already operating across the U.S., totaling over 14 GW of aggregate capacity. Some of the most common configurations include wind+storage (13 projects, 1,290 MW wind, 184 MW storage) and PV+storage (40 projects, 882 MW PV, 169 MW storage). Many other configurations exist, for example, fossil+PV, fossil+wind, wind+PV, hydro+storage, geothermal+PV, CSP+storage, and more. Wind hybrids have been most common in ERCOT (The Electric Reliability Council of Texas) and PJM (an Eastern U.S. grid operator), with PV hybrids coming online in the non-ISO (independent system operator) West, ERCOT, and Southeast.[6]

5. Linkage of Interdependent and Interactive Communications, Data, Transportation and Building Systems

Bringing energy intelligence to the grid efficiently balances generation and

New renewable energy capacity hit record levels last year with almost

75%

of new electricity capacity being renewable.

demand while generating new opportunities to increase revenue streams and cybersecurity. Most of the innovation is at the "grid edge" where power quality and reliability is poor, and allows more decentralized, distributed and clean energy to build market niches.[7]

A November 2019 paper by Sneya Ayyagari and Matt Jungclauss entitled *Innovation Opportunities in Grid-Interactive Efficient Buildings*[8] aptly lays out this new trend: "What if buildings could communicate with the electric grid to save money and reduce their environmental impacts? Buildings drive up to 80% of the peak demand on the grid, and peak demand drives grid investments in generation, transmission, and distribution assets, so there is a huge opportunity to balance building demand with electricity system supply." Through demand management and load flexibility, grid-interactive energy efficient buildings (GEBs) leverage technologies and strategies to address this issue. GEBs optimize energy efficiency, energy storage, distributed energy generation, and load-flexible technologies, as well as interface with electric vehicles to match evolving needs of the electricity system. This provides a more flexible building energy load profile with lower peaks, reducing building operating costs through demand-charge savings.

LF Energy has launched its Digital Substation Automation Systems initiative, creating a more modular grid.[9] It looks to make interoperable substations that are both hardware and software agnostic. A digital substation de-aggregates hardware and software, so you can use commodity hardware in order to run software. This decreases cost as the system will be able to abstract the hardware by creating software-defined hardware, meaning that the hardware used in a substation won't matter, because all hardware will be compatible with the same, open-source, software, essentially creating plug-and-play substations. The idea is to take generation assets like a PV system and think about their generation less from a control perspective and more from an orchestration perspective.

6. Financial Tools (On-Bill Financing, C-PACE, and Others) Supporting Technology Evolutions

Already, at least 110 utilities in 33 states offer on-bill financing (OBF). At least 13 states have passed legislation enabling OBF, and programs are under consideration in several more.[10] Such programs are successfully supporting a wide range of products and services that will pay for themselves through avoided utility bills, including electric, heating-fuel, water, and wastewater bills.[11] Examples include:

- Energy efficiency improvements, including whole building retrofit services and high-efficiency new construction;
- High-value energy efficiency improvements such as new high-efficiency major appliances and heating, ventilating, and air conditioning (HVAC) equipment, including solar water heating, grid-integrated water heaters, ice-storage air conditioning, and heat pumps including ground-coil loops for earth coupled heat pumps;
- Both indoor and outdoor lighting, including street lights and security lights, with wired or wireless options;
- Remote, off-grid equipment, such as livestock-watering and irrigation systems using solar pumps;
- Rooftop solar and community solar, with some programs including battery storage and some eligible for both on- or off-grid installations;
- Battery storage and uninterruptible power supplies, including systems for customers needing medical devices or other critically essential needs, and;
- Electric vehicle charging stations.

The property assessed clean energy (PACE) model is an innovative mechanism for financing energy efficiency and renewable energy improvements on private property. PACE programs exist for:

- Commercial properties (commonly referred to as Commercial PACE or C-PACE)
- Residential properties (commonly referred to as Residential PACE or R-PACE).

Established by local governments, PACE allows property owners to finance up-front costs of energy efficiency and renewable energy on their property and building(s) and to pay back over time through a voluntary assessment. The assessment is attached to the property rather than an individual or company. Local governments set up a "land-secured financing district" also known as an assessment district or local improvement district. The local government issues bonds to fund these projects for these districts, which serve a public purpose, similar to how they fund parks, schools, water, and sewage projects.[12]

Residential PACE allows homeowners to finance energy efficiency, renewable energy and other eligible improvements on their homes using private sources of capital. According to PaceNation, as of 2019, over 200,000 homeowners have made $5 billion in energy efficiency and other improvements to their homes

through PACE financing, and investments for commercial PACE projects have topped $1,538,240,000.[13]

7. Mass Sales Beget Market Penetration and Economic Might

As global sales increase and installed costs of all renewables and energy storage decrease, we see a massive market shift. A recent report from The International Renewable Energy Agency (IRENA) showed that new renewable energy capacity hit record levels last year with almost 75% of new electricity capacity being renewable. New solar power provided 55% of this new capacity, most of which was installed in Asia, with China, India, Japan, South Korea and Vietnam leading the way. Other major increases were seen in the US, Australia, Spain, Germany and Ukraine. Wind power made up 34% of the total, with almost half in China and significant additions in the U.S. Global wind power capacity remains just ahead of solar, with 95% being onshore turbines.

Other green technologies – hydropower, bioenergy, geothermal and marine energy – all grew modestly year-over-year. While small compared with solar and wind power, geothermal energy – tapping the heat of deep rocks – is growing, with Turkey, Indonesia and Kenya leading the way.[14] Zion Market Research reports the global geothermal energy market was valued at approximately $4 billion in 2018 and is expected to generate around $9 billion by 2025.[15]

According to SolarPower Europe's new "Global Market Outlook", which analyzes solar installations in 2019, and forecasts capacity for 2020–24, the global solar sector will reach terawatt scale by 2022 – just four years after the 500 GW milestone was reached. Other milestones to expect in the next few years include solar reaching 700 GW by the end of 2020, and 1.2 TW by 2023.[16]

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Global wind power capacity remains just ahead of solar, with 95% being onshore turbines.

For the first time ever in the history of the U.S. power grid, renewable energy is beating coal. We are witnessing transformative technological change moving at warp speed in the midst of two global emergencies – and climate change and the COVID-19 pandemic. These advanced integrations of technologies with enhanced sensors, controls, and algorithms give us the reliability, agility, resiliency, reliability, and environmental optimization necessary to address climate change, this and upcoming pandemics, and other global challenges. While these changes have the potential to ease these challenges, greater global cooperation between multilateral organizations, national governments, and the financial and banking sectors need to be heightened and accelerated. ■

About the Author

Scott Sklar is President of The Stella Group, Ltd.. a strategic technology optimization and policy firm for clean energy users and companies, with a focus on system standardization, modularity, and web-enabled diagnostics. Scott Sklar is also an Adjunct Professor at The George Washington University teaching three unique interdisciplinary sustainable energy courses including the first course in the USA on "Renewable Energy & Critical Infrastructure". Sklar is the Energy Director at GWU's Environment and Energy Management Institute (EEMI).

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Cookin' in the Sun

By Barbara Lunde

Solar cooking is lots of fun, with many advantages. It is the simplest and most convenient way to cook without consuming fuel or heating up the kitchen. You supply no fuel and emit no carbon dioxide or smoke. Food does not burn. Below I describe several types of solar cookers.

Panel Solar Cooker

The simplest and lightest solar cooker is a panel solar cooker, such as the Haines 2 *(see Figure 1)*. It weighs less than two pounds and costs about $65. You assemble it in about five minutes and face it toward the sun. For faster cooking, if your recipe takes more than an hour, you rotate the cooker a little every hour to face the sun again. Put your food in a black or glass pot with a glass cover and put the pot in the panel cooker. In an hour or two, on a sunny day, you will have cooked food. At 86 degrees air temperature, a quart of water can come to a boil in 48 minutes. When you've finished cooking, the cool solar oven folds into its shipping box of 1/3 cubic feet for storage.

The website for the Haines cooker is hainessolarcookers.com.

Parabolic Solar Cooker

The parabolic solar cookers are the most spectacular *(see Figure 2)*. The Sunplicity is almost as light and easy to set up as a panel solar cooker. The Sunplicity weighs six pounds. You can set it up in one minute to make a 33" diameter dish that collects sunlight and focuses it on your cooking vessel. It will heat a small vessel to 445 degrees in less than 10 minutes, or It can bring a quart of water from 70 degrees to boiling in half an hour. It costs about $400 and concentrates the energy in a smaller volume than a panel cooker, so it is more useful in colder climates. It does need to be aimed to face the sun again about every hour. If you get distracted and leave your cooking unattended, the focal point of the sun, providing heat to the food, will move, and the cooking will stop. The food will not be over cooked. The cooker is made in workshops in France that employ people with disabilities. The website is sunplicity.fr/en/parabolic-cooker. It is safe by design, because the focal point of the mirrors that forms the hot spot to cook the food is inside the mirrored dish, so nothing outside the dish can be accidently set on fire.

An additional design of parabolic solar cookers takes the shape of a tube, such as those made by GoSun – see gosun.co/collections/solar-ovens.

Box Solar Cooker

The most common type of solar cooker

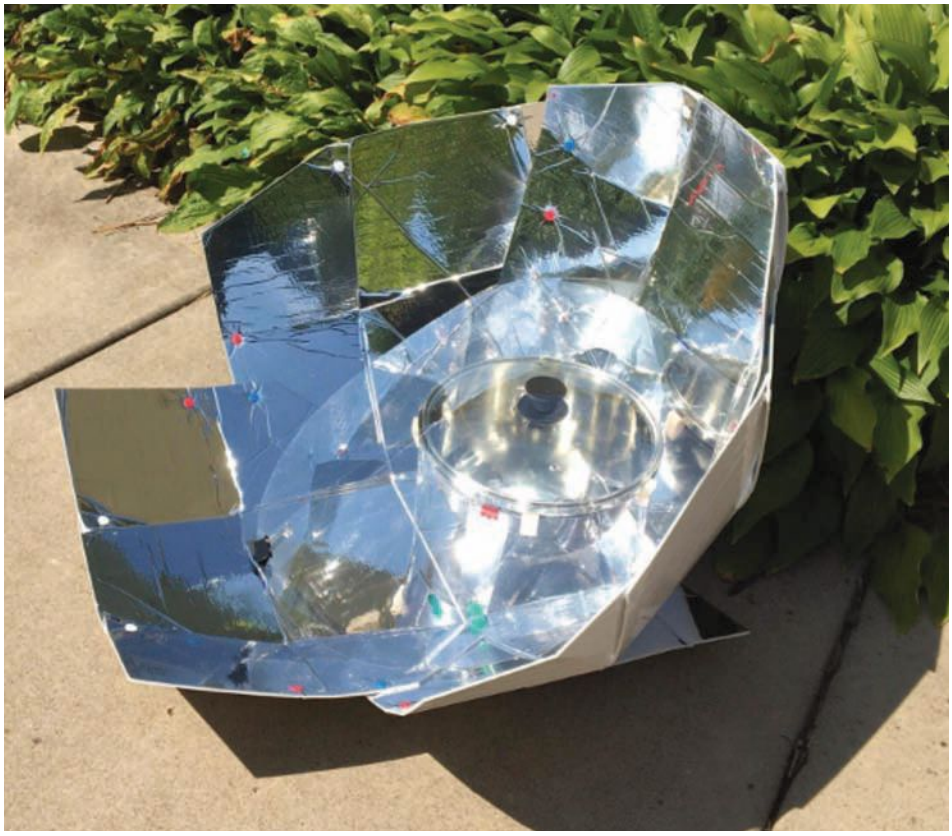

Figure 1. Haines 2, a panel cooker, boiling water.The red, white, or blue dots are actually parts of snaps that hold the cooker together.There are two sets of snaps.The correct snaps to use depend on the sun angle. In Minneapolis, we use the blue snaps.

Luther doesn't have three heads. You are seeing him and reflections of him in the upper and lower mirrors that feed sunlight into his indoor solar cooker.

© Barbara Lunde

Figure 2. The parabolic Sunplicity Solar Cooker in Luther Krueger's Solar Cooker Museum.

is the box solar cooker, such as the Global Sun Oven *(see Figure 3)*. This is an insulated 19" by 19" box, 11" deep with a black interior, four exterior reflectors, and a tempered glass lid. It weighs 23 pounds and costs $330. When opened, the reflectors are 33" across the top. Its website is sunoven.com. Box cookers, in general, can cook more food at the same time than a parabolic cooker. Delivery of Sun Ovens has been delayed in July 2020, because of high demand due to COVID-19. Other box cooker manufacturers have also seen increased demand due to the pandemic.

Hybrid Solar Oven

Another type of solar oven is called a hybrid *(see Figure 4)*. It is a box cooker with a 465-watt electric cooking element. If clouds come, and electricity is available, you can finish your cooking as you would in a Crock-Pot. An example is the UGLI Hybrid Solar Cooker. This is 22" by 22" by 12" high, plus extra reflectors. It weighs 32 pounds, and costs about $420. The website for this oven is sunbdcorp.com/product/ugli.

All the reflective solar ovens use aluminum for reflection. Some use spectral grade aluminum sheeting and some use aluminized mylar. Fresnel lenses are being adapted as collectors of solar energy.

Solar cookers seem particularly good for areas near the equator, with lots of sun, and often few sources of energy. In some cases, women walk for miles daily looking for wood fuel for cooking. The sun provides energy for free. International charities have manufactured and shipped large quantities of ovens to cook food, without the environmental and human effects of wood use, including smoke inhalation. For example, over the 4th of July weekend, 2020, a shipping container of solar cooker kits was sent by a church in Pierre, South Dakota to the Dominican Republic. They require those who want a solar cooker to attend a two-day course in solar cooking and pay $20 to get one.

Solar Cooker Museum

Luther Krueger collects, demonstrates, designs, and promotes solar cookers in south Minneapolis, Minnesota. He has a museum of solar cookers in his backyard. His museum hosts Solar Cooking Brunches. When the upcoming weather forecast is for full sun, he invites guests to bring food to cook. He provides the pots and appropriate solar cookers. It is a relaxed atmosphere, because solar cooking is not a speed sport. Except for the occasional redirection of the solar cookers to the apparently moving sun, guests can relax while their food cooks. The northwest corner of the yard is shaded by a tree and has chairs and a table. The tree provides welcome shade on sunny days. Of course, the solar cookers are in the sun, but the cooks can relax in the shade.

In 2004, he began collecting solar cookers. One by one, he acquired classic designs

Figure 3. Sun Oven Box Solar Cooker

© sunoven.com

and contemporary models, made all over the world. He once drove to Oregon to get one of the few remaining solar cookers of a particular parabolic design. Luther is a font of knowledge about solar cookers. He has at least 57 cookers and appropriate accessories. The museum's mission is to demonstrate that any dish, from any culture, can be cooked using solar energy, in a cooker appropriate for the task. Each cooker in the collection has been used or tested and is made available for hands-on cooking by the guests.

His one nod to Minnesota is that he has installed a unique solar window on the south side of his backyard studio *(see page 12)*. It is double pane, with generous, adjustable reflectors above and below the window. The window Is 18" by 13" and forms the side wall of a solar cooker, which is inside the heated studio. This allows him to solar cook inside, effectively extending the solar cooking season.

Luther is seeking a more permanent location for his solar cooker museum and welcomes your questions and ideas by email at kruegarian@gmail.com. ■

About the Author

Barbara Lunde, PE, PhD (Physics), designed and supervised construction of a solar steam generator for the Iowa Capitol Complex in 1977 and a residential solar water heater. She is a member of ASES and on the board of the Minnesota Renewable Energy Society (MRES). She has exhibited and answered questions about solar energy in Minneapolis, St. Paul and Duluth in Minnesota and in central Iowa. Recently, she has been analyzing the output of MRES' Solar Garden, designed to serve .200 low income families.

© Barbara Lunde

Figure 4. Luther adjusting the UGLI Hybrid Solar Cooker

DIY Solar Cooker Designs

You can also make your own solar cooker for a very low cost. Check out these guides:

- **homesciencetools.com/article/how-to-build-a-solar-oven-project**
- **education.com/science-fair/article/design-solar-cooker**
- **instructables.com/id/Best-Solar-Oven**

INTELLIGENT ENERGY:

Operating System for the Solar Homes and Microgrids of the Future

By Timothy Schoechle, PhD

This article features the Energy Management and Metering Architecture (EMMA) technical international standardization initiative of the International Electrotechnical Commission (IEC) as a key to the transition to a sustainable and resilient utility of the future. These standards are under continuing development in ISO/IEC Subcommittee 25 (Interconnection of IT equipment) under the IEC in collaboration with its international sister committees and outside liaison groups including the Smart Electric Power Alliance (SEPA), the GridWise Architecture Council (GWAC), and others. The IEC was established in 1907, with the introduction of electricity, for worldwide standardization of wires, plugs, transformers, the electric grid, and electrical products.

© Nicole Fuller

A consequence of the looming climate crisis has been the failure of electric power grids in many parts of the country due to devastating wildfires and other severe weather events. For example, recently towns in parts of California have been burned, left without power, or entirely destroyed. This was attributable in part to vulnerable transmission lines together with high winds and extreme drought conditions. Severe windstorms have recently flattened parts of Iowa, also leaving whole communities without electricity.

Many cities and communities have adopted goals to achieve a 100% renewable electric supply within the next decade. Achieving a renewable, sustainable, and resilient electricity system has become of primary importance and has introduced a new way of looking at how to structure an electric grid, as damaged communities are being rebuilt or existing systems are being improved. One way to move toward 100% is to replace carbon with renewable generation, but centralized grid structures and variability of wind and solar make the last 10-20% hard to achieve. An alternative approach is decentralization and "microgrids".

Enter: Microgrids

An important key to the 100% goal will be the ability to implement solar and storage technologies at the distribution level, generating local power on or near the premises where it is used. Such systems can facilitate sharing of electricity in coordination with other homes and buildings within the local

Above: Transitional hybrid grid: combined centralized and solar microgrid.

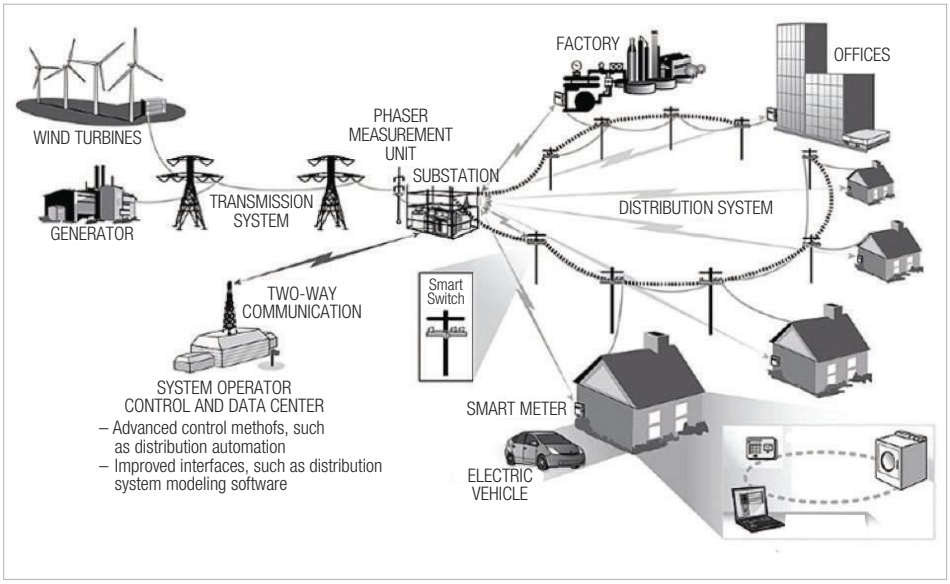

Figure 1: Conventional centralized electricity grid.

community as a semi-independent, detachable district or neighborhood—known as a *microgrid*. This approach is made feasible by the dramatic reduction in the cost of solar photovoltaic (PV) panels, batteries, and power electronics.

Such a distributed energy system depends on automated control of premises-based generation, use, and storage of electricity, and on coordination with the other nearby premises as a microgrid. To achieve such control involves carefully managing certain essential on-premises equipment including solar inverters, batteries, and appliances (e.g., electric vehicle chargers, heating and cooling equipment, water heaters, refrigeration, and other "smart" devices). Suchmanagement is the goal of a newly emerging standardized premises gateway and a platform for Energy Management and Metering Architecture, EMMA—the ingredient that makes these elements work together to balance and optimize local energy.

The recent availability of new economical consumer-scale electricity technologies for generation, use, and storage (e.g., solar PV, batteries, power electronics, appliances, controls, and communications protocols) offer a powerful way to answer the question of how to eliminate carbon and get to 100% clean renewable energy. This path supplements the historical producer-oriented view that built our electric system with a local consumer-oriented view.

Figure 1 shows a model of the present electricity grid where electricity flows from utility scale generators on the left, through transmission lines, to distribution facilities, and ultimately to the customers on the right. Although some buildings or substations may acquire solar and/or storage (commonly called "distributed energy resources" or DER), it is not depicted in diagrams such as this because, until recently, such resources have been seen as adjunct or ancillary—the primary generation and control model remaining centralized and consistent with the historical industry grid paradigm.

However, it is becoming clear that in order to achieve the climate change goals and to increase the resiliency of the electric system which will be required to handle the disruptive weather events brought on by climate change, this historical model needs to be extended to incorporate the emerging vision described here—introducing a new alternative, yet complementary, grid paradigm. The distributed consumer-oriented (and consumer-scale) technologies bring new localized[1] options (e.g., customer premises-based solar PV, storage, and microgrids, etc.) which can deliver levels of renewable energy, reliability, and resilience not previously possible. Local clean energy also delivers reductions in generating and transmission costs—and pollution.

These localized options are based on a grid network incorporating distributed quasi-independent community microgrids composed of individual prosumers, where every consumer is also a potential producer. These microgrids offer a new level of resiliency as well as efficiency, reliability, and decentralized autonomy by allowing microgrids to continue to function when the larger grid fails. Each microgrid is based on resources situated on-premises or within the distribution grid, including solar PV, batteries, "smart" inverters, premises control systems, and high-speed communications networking.

Some may have concerns that the new distributed paradigm may be incompatible with the existing system, may disrupt a century or more of established institutional structures, or may strand, or make obsolete, massive investments in older generation and transmission facilities. Certainly, business and technical adaptations will be necessary, however, experience has shown that the two paradigms can be mixed well, and that the newer facilities can actually improve overall grid capacity, stability, and resilience. They can also give utilities more options as they shift to the more climate-friendly model that the public is increasingly demanding.

The Localized View

The localized view is a "bottom-up" perspective that sees the home or building as an "island" that generates, uses, and stores power—like a boat or RV.[2] From this perspective, the power management problem becomes one of primarily managing the local premises resources, and it considers the electricity grid as a massive energy source—a big battery to be charged and discharged. With the widespread installation of solar-plus-storage, every home and building can utilize rooftop or adjacent space and become a potential contributor, as a generator, user, and store of energy.

This locally-sourced energy can be first managed on-premises, then within the community, and finally within the local distribution feeder or grid. Such a perspective offers to greatly reduce the demands on the grid and to vastly simplify the overall control problem by letting each premises manage its own energy. When combined with advanced methods for sharing of energy among premises (e.g., using dynamic pricing mechanisms, "transactive" control tariffs, etc.), the local utility grid management/control problem can be further simplified.[3]

EMMA Manages Premises and Local Energy

This local approach requires a technology which enables the required component interconnection and management. This brings us back to what Energy Management and Metering Architecture (EMMA) provides. EMMA is part of a premises control system known as the ISO/IEC HES gateway platform, or HomeGate™, developed by a set of international standards committees, that provides an array of communication and control functions for the home or building.[4] EMMA is intended as also part of a local electricity distribution microgrid for enabling coordination of electricity

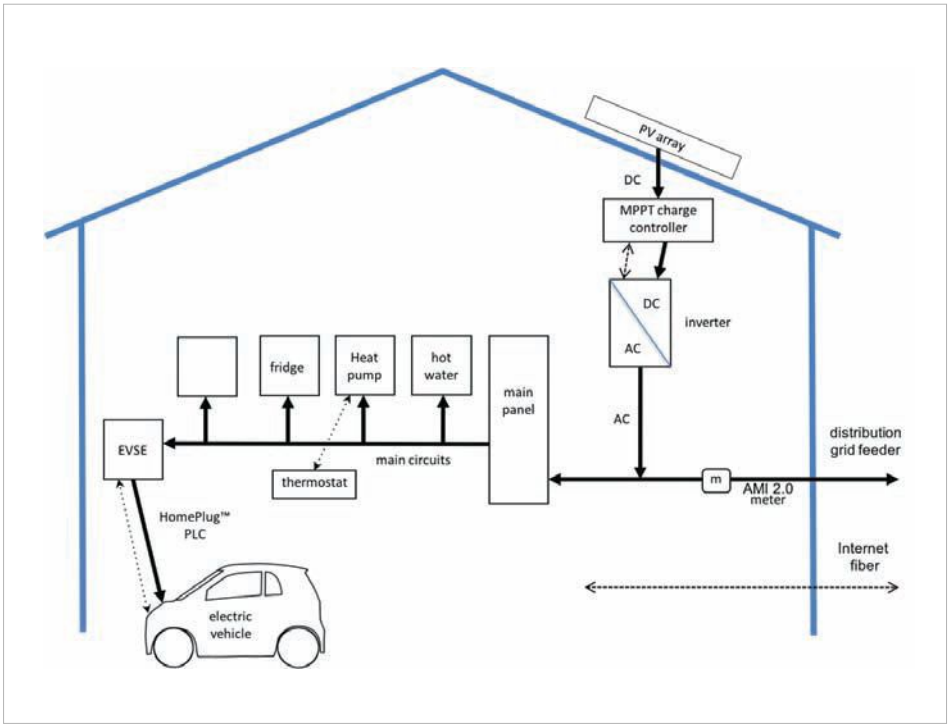

Figure 2: Conventional premises general architecture, with solar PV (no storage)

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flows—sharing power between neighboring premises by utilizing advanced demand response protocols, dynamic pricing tariffs (or similar means), and a reliable local high speed fiber optic network connection.

Premises Energy System Architecture

Presently, a local rooftop solar PV system without storage sells all its excess solar energy directly to the grid. Unfortunately, the solar may not be producing at the optimal time of day and may overload the grid. The solar-plus-storage model, enabled by EMMA, shown in *Figure 3*, adds storage to correct this condition. This model entails four important key concepts that define the EMMA premises environment.

The first key concept in the new solar-plus-storage model is that premises load circuits are divided between two circuit breaker panels, a main panel and a priority load panel. The priority load panel controls circuits that will continue to be powered by the battery/inverter system in the event of grid power interruption. The main panel controls the other load circuits in the building, and these will lose power whenever the grid loses power.

> "...it considers the electricity grid as a massive energy source—a big battery to be charged and discharged.

A second key concept in the EMMA model is the expanded solar-plus-storage element shown in *Figure 3*. This element consists of a "smart" DC-coupled inverter that has two bi-directional AC output/input ports to serve the two circuit panels. The grid is connected to the house via the main panel, as usual. The inverter draws DC power from a 48 Volt DC bus (connection) to generate AC for the house. The battery is connected to the 48 Volt DC bus and can be charged from the grid by the inverter, if needed. The 48 Volt DC bus is charged by the solar array and charge controller, also charging the battery. In the future, household devices (many of which already operate internally on DC) could be powered directly by the DC bus, saving the energy that is currently lost by converting DC to AC and then back to DC.

A third key concept is the EMMA control system that measures and manages electricity within the residence, communicating directly with all major premises devices, including "smart" appliances and metering sensors. The EMMA standardized software resides in a "gateway" or "platform" that also hosts other application services ("apps"), and communication interfaces for home devices and external networks. The EMMA software functionality[5] provides the conventional utility metering functions consistent with the Advanced Metering Infrastructure (AMI) standards. The *HomeGate* standards also include provisions for consumer privacy, cyber-security, and safety services for protecting the premises, its occupants, and devices.

A fourth key concept is the ability of EMMA to communicate with the grid and with other premises (using a local public optical fiber network) to negotiate the sharing of energy with neighbors, depending on its own conditions and on external supply/demand conditions, essentially in real-time. One class of protocols and tariffs for this purpose is known as *transactive energy (TE), currently under development*.[6]

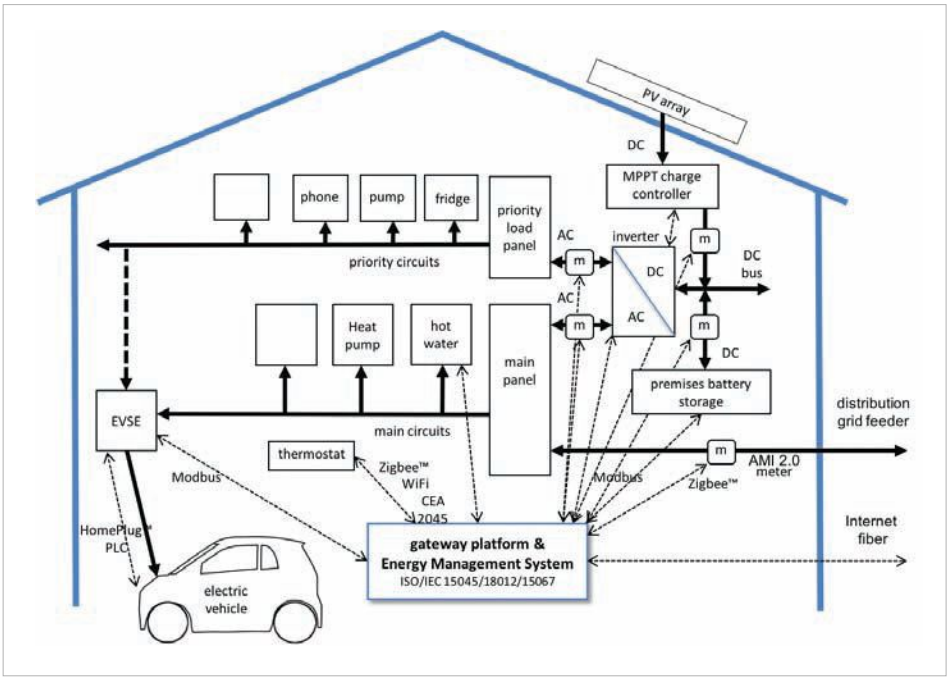
Transition to the Utility of the Future

With this approach, the home or premises will be a new parallel building block of the "utility of the future". Individual premises will be able to use their solar PV generation and battery storage to operate in a semi-autonomous manner in case of failure of the local grid. Distribution feeders that connect buildings to a substation will be arranged in microgrids that can allow clusters of buildings, campuses, or communities to operate in a semi-autonomous manner sharing and optimizing their energy—contributing resilience and efficiency to the overall grid.

The utility will continue as a large scale energy provider, while also maintaining its substations and distribution grid (i.e., poles, wires, and transformers) and will also continue to buy or generate electricity, selling it to consumers wherever necessary, but will move in parallel toward enabling its prosumers to generate and store much of their own energy. Because all homes and buildings may not be suitable for solar PV, utilities will also build or enable community-based (distribution level) solar gardens and storage facilities, where appropriate.

Strategies for this transition will vary depending on the local situation. One strategy will be to phase in premises solar-plus-storage and local solar gardens. The utility would also implement energy sharing methods such as transactive energy and work toward reducing external energy purchases and transmission where possible. *The utility might also develop incentives to install solar-plus-storage and fiber networks from the cost savings on avoided power purchases.* The fiber broadband service would also be a recurring revenue source, incurred from providing internet access to

Figure 3: HES/EMMA premises architecture, with solar-plus-storage.



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customers, as an added benefit. Rooftop-scale solar and storage could be installed much more rapidly than large generation and transmission projects that must meet more extensive environmental impact, financial, public review, and other permitting requirements (i.e., weeks vs. years). In any case, the power grid will likely be a hybrid of the conventional centralized grid and the new distributed energy grid for a long time, as depicted on page 16-17.

Conclusion

By building distributed microgrids with *Energy Management and Metering Architecture (EMMA)* as a foundational building block, utilities can gain a key advantage in meeting their 100% renewable, and sustainable energy goals. They may be able to get there more quickly than by relying entirely on centralized wind and solar farms or other large renewable facilities. Local permitting and approval requirements can be managed under local governance. Utilities can also structure attractive subsidy, financing, or incentive programs to encourage their customers to undertake much of the capital expense of installing the systems. EMMA can help utilities can gain a key advantage in achieving their 100% renewable, sustainable, and resilient energy goals on the aggressive schedule which the public is increasingly demanding. ■

Resources

1. In this context, "localized" means located within the local distribution grid on lower voltage substations or feeders.
2. bit.ly/2YyuRc6
3. bit.ly/3lgTnbq
4. ISO/IEC 15045 HES gateway series and ISO/IEC 18012 Product Interoperability series
5. ISO/IEC 15067-3 Energy management model
6. bit.ly/3lgTnbq

USDA Rural Energy for America Program (REAP) Renewable Energy and Energy Efficiency supports small rural businesses and agriculture producers purchase, install, or construct renewable energy systems and energy efficiency improvements.

Federal Funding Supporting Renewable Energy and Energy Efficiency

By Bill Hagy

Need cash for the farm? There are federal programs that support renewable energy and energy efficiency development for businesses, non-profit organizations, public bodies (town, city, municipality), agriculture producers, Native American Tribes, cooperatives, community-based organizations, and institutions of higher learning.

The programs support research and development in energy derived from solar, wind, renewable biomass, ocean (including tidal, wave, current, and thermal), geothermal, hydroelectric sources, and hydrogen derived from renewable biomass.

Each federal program is unique in the type of eligible recipients, project locations, and purpose. Some of the programs are limited to small businesses and businesses located in

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> **http://bit.ly/2cBmuUF**

a rural area of the United States and U.S. Territories. Funding assistance can be in the form of a grant, direct loan, loan guarantee or a combination. Some programs receive applications year-round while other programs publish funding opportunity application windows on an annual basis.

Each program has unique requirements as to the maximum amount of the total project costs that can be provided by the program; applicant contribution; matching funds; any restrictions; and location where applications can be received. For some USDA programs, USDA State or Local offices are the entry point for application while other programs are administered out of the USDA National Rural Development Office. Information provided in the individual program fact sheet will provide contact information for filing applications.

The following is a brief description of the federal programs and a link to Fact Sheets that provide more detailed information on each program:

USDA Business and Industry (B&I) Loan Guarantee Program supports businesses located in a rural area to install commercially proven renewable energy facilities and make energy efficiency improvements for the business. A rural area for this program is any unincorporated area and cities or towns with a population of 50,000 or less. An eligible business includes for-profit business, nonprofits, cooperatives, Native American tribes, public bodies, and individuals. The maximum loan guarantee is $25 million. Applications are received and processed throughout the year.[1]

USDA Rural Energy for America Program (REAP) Renewable Energy and Energy Efficiency supports small rural businesses and agriculture producers purchase, install, or construct renewable energy systems and energy efficiency improvements. A rural area for this program includes any area other than a city or town with a population of greater than 50,000 inhabitants and the urbanized area of that city or town. The definition of "small" is based on the Small Business Administration definition of small business for the type of business.

An eligible agricultural producer includes an individual or entity directly engaged in the production of agricultural products, including crops (including farming); livestock (including ranching); forestry products; hydroponics; nursery stock; or aquaculture, whereby 50 percent or greater of their gross income is derived from those products.

The maximum loan guarantee is $25 million and maximum grants are $500,000 for renewable energy and $250,000 for energy efficiency awards per eligible applicant. Loan guarantee applications are received year-round while grants and combination grant and loan guarantee applications will only be accepted during a funding announcement window published annually in the federal register.[2]

USDA Rural Energy for America Program (REAP) Energy Audit and Renewable Energy Development Assistance Grants provide energy audits and renewable energy development assistance to rural small businesses and eligible agriculture producers via an eligible applicant. The same definitions of small, rural, and agricultural producer that apply to the REAP Renewable Energy and Energy Efficiency also apply for this program. Eligible applicants for this program include: A unit of state, tribal, or local government; a land-grant college or university, or other institution of higher education; a rural electric cooperative; a public power entity; an instrumentality of a state, tribal, or local government; or a council. The maximum grant is $100,000 to an eligible applicant.[3]

USDA Rural Business Development Grants (RBDG) can be used to support feasibility/marketing plans, business plans, professional/technical reports, and community economic development for small and emerging small rural businesses via an eligible applicant. A small and emerging business includes any private and/or nonprofit business which will employ 50 or fewer new employees and has less than $1 million in gross revenue. A rural area for this program includes any area other than a city or town with a population of greater than 50,000 inhabitants and the urbanized area of that city or town. An eligible applicant includes public bodies and private or nonprofit corporations serving rural areas. Public bodies include states, counties, cities, townships, and incorporated town and villages, boroughs, authorities, districts, and Indian tribes on Federal and State reservations and other federally recognized Indian tribal groups. RBDG grants range from $10,000 to $500,000 per project. Funding is made available via funding window announcement published in the federal register each year.[4]

USDA Rural Economic Development Loan and Grant (REDLG) Program contains the Rural Economic Development Loan (REDL) and Grant (REDG) programs that provide funding to rural projects through local utility organizations. Under the REDL program, USDA provides zero interest loans to local utilities, which they, in turn, pass through to local businesses (ultimate recipients), for projects that will create and retain employment in rural areas. Under the REDG program, USDA provides grant funds to local utility organizations to use the funding to establish revolving loan funds (RLF).

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Federal programs will support research and development in energy derived from solar, wind, renewable biomass, ocean (including tidal, wave, current, and thermal), geothermal, hydroelectric sources, and hydrogen derived from renewable biomass.

Loans are made from the revolving loan funds to projects that will create or retain rural jobs.

A rural area for this program is any unincorporated area and cities or towns with a population of 50,000 or less. Eligible applicants include any former Rural Utilities Service borrower; nonprofit utilities that are eligible to receive assistance from the Rural Development Electric or Telecommunication programs; or current Rural Development Electric or Telecommunication borrowers. Maximum loan is $1 million and maximum grant is $300,00 per applicant. Funding is made available via funding window announcement published in the federal register each year.[5]

DOE Renewable Energy & Efficient Energy Projects Loan Guarantee Program provides funding to projects located in the United States that employ innovative and renewable or efficient energy technologies that avoid, reduce, or sequester anthropogenic emission of greenhouse gases. Funding availability is announced through a funding solicitation announcement. There is no limit on the size of loan guarantee per project.[6] ■

About the Author

Bill Hagy is an ASES member, rural community sustainability and economic development consultant, and bioenergy expert. He served 37 years to the USDA where he was the Director for Alternative Energy Policy. He has received the National Rural Economic Developers Association President's Award, Vice President Gore's National Performance Review Hammer Award for efforts in streamlining the B&I Guaranteed Loan Program regulation, and was named one of the "Top 100 People in Bioenergy" by Biofuels Digest.

Resources

1. bit.ly/34IKW2X
2. bit.ly/2QBQXpE
3. bit.ly/3gEAEmP
4. bit.ly/3b6LRLv
5. bit.ly/2YK3FHD
6. bit.ly/3hFyPY3

While the Trump Administration has already given the fossil industry much of its wish list, lobbyists are planning much more if he is re-elected, says E&E News. © Sergei Dubrovskii

Fossils vs. Clean Energy: The Standoff That Never Ends

By Rona Fried, *Ph.D.*

As climate change bears down on planet Earth, people wearing masks and trying to social distance will have compounding threats to deal with. This year's hurricane season is forecast to be among the worst yet with 24 named storms expected – about double a typical season, say researchers at Colorado State University.[1]

Calls for a green economic recovery from the coronavirus pandemic have been widespread, but so far fossil fuels have been among the biggest recipients of aid, with clean energy left behind. Amazingly, none of the money given to oil and gas companies has helped workers who have lost their jobs. The only help clean energy companies have gotten: flexibility on paying taxes for renewable energy projects from the US Treasury and IRS. On the other hand, oil and gas companies have been able to claim losses retroactive to 2018, received funds they can use to pay off debt, and whittled royalty payments to US taxpayers down to almost nothing for drilling on public lands. But while fossil drillers pay as little as 0.5% royalties, solar and wind companies that build on public land saw their two-year rent holiday ended...and demands for payment retroactively![2]

Even worse, oil and gas lobbyists succeeded in voiding pesky rules that require them to monitor and test wells if it's too much of a burden during the pandemic. This has worked out well for bankrupt fracking companies: they just leave their wells spewing methane into the atmosphere, while executives get paid huge bonuses. Who pays the tens of millions of dollars to close two million uncapped wells and clean up the mess? US taxpayers, says the *New York Times*. Nine states are suing the Environmental Protection Agency (EPA) for that.[3]

Of 100 environmental rollbacks as of May 29, 2020, here are just some that favor fossil fuels:

- fossil companies no longer have to report methane emissions
- water pollution regulations are nullified for fracking on federal and Indian lands
- safety rules are eliminated at hazardous chemical sites
- safety regulations are weakened

for offshore drilling put in place after BP Horizon disaster

- coal companies can dump mining debris directly into local streams
- vehicle fuel efficiency standards are weakened significantly
- oil drilling is encouraged in the Alaska National Wildlife Reserve (ANWR)
- states aren't allowed to reject fossil fuel projects
- toxic coal ash can continue to be dumped in the 400 unlined pits across the U.S.

While the Trump Administration has already given the fossil industry much of its wish list, lobbyists are planning much more if he is re-elected, says E&E News.[4]

Their priorities include cutting renewable energy standards, winding down renewable energy incentives, waiving shipping rules for liquefied natural gas, much more drilling on public lands and offshore waters, and an all-out assault on environmental regulations. While Trump's EPA has already stacked the deck by changing the way it calculates the cost-benefits of environmental rules, they want the focus to be on cost. They want an analysis on what the government spends on climate change as well as go back to court to determine if the government even has the right to regulate anything related to it.

Under cover of the coronavirus pandemic, the Trump administration is working on it. No other administration has tried to change the very mission of federal agencies that oversee our public lands.

When Congress sets land aside for forests, wilderness and grasslands, they are protecting the most biodiverse, important natural areas in the US - 193 million acres so far. No more. Oil, logging, mining, and grazing are the new priorities for the U.S. Forest Service![5]

In a one-two punch, they recently gutted the 50-year-old National Environmental Policy Act (NEPA), which requires environmental reviews of major projects, followed by public input. A raft of non-profits are going to court to reinstate NEPA.

This formalizes what environmental groups have been fighting for almost four years. For example, as the Forest Service moved to log our largest old growth forest - Alaska's Tongass National Forest -environmental groups stopped it in court. And a federal court recently invalidated 440 oil and gas leases the Forest Service sold on 336,000 acres sold across the West.

It's not just about our public lands. Destroying NEPA means companies will be free to put pipelines through our backyards or incinerators near our schools.

Invest in a Green Economy to Rebuild after COVID

Meanwhile, countless reports show that the way to revive our economy is through an aggressive national commitment to turning our nation Green. It would by far produce the most jobs...and well-paying, healthy jobs.

For example, *Mobilizing for a Zero Carbon America*[6] shows that 25 million good-paying jobs would be created in electrifying our economy over the next 15 years. "For a world looking to bounce back from a pandemic, there is no other project that would create this many jobs," say the authors.

Another report, *Build Back Better, Faster: How a Federal Stimulus Focusing on Clean Energy Can Create Millions of Jobs and Restart America's Economy*,[7] focuses on investments in energy efficiency, renewable energy and grid modernization, which alone would create 860,000 jobs.

"A return to 'business as usual' would not just be a monumental failure of imagination, but lock in the inequities laid bare by the pandemic and the inevitability of more devastating crises due to the climate breakdown," says the group C40, in their report *C40 Mayors Agenda for a Green and Just Recovery.*[8]

Their plan includes investing in clean energy and job training to help people transition from polluting industries to sustainable ones. It emphasizes improving public services like mass transit, creating "15-minute cities" where people can meet much of their needs in a short walk or bike ride from home, and investing in parks, green roofs, and infrastructure that reduces the risks of extreme heat, drought and flooding. ■

About the Author

Rona Fried, Ph.D., is President of SustainableBusiness.com, a thought leader on green business known for its daily news and Green Dream Jobs service since 1996.

Resources

1. bit.ly/2Fs1uS0
2. bit.ly/323UrGH
3. on.ny.gov/2E4U2vL
4. bit.ly/3g5BOr7
5. bit.ly/345xpSF
6. rewiringamerica.org/jobs-repor
7. bit.ly/3kXgfQ7
8. bit.ly/31YJgPP

Living Off-the-Grid: A Mental Versus Physical Proposition

By Leaf Running-rabbit

Earth continues floating in rotation, the seasons keep changing, crises in the form of pandemics, violence, -isms, and bipolar division within our great country continue persisting, and Humanity is partially awakening and partially sleeping. These are very interesting, if not very intriguing, if not very unknown, if not very unknowing… times for us all, living both on and off-the-grid (in the physical sense of the word).

Regardless of how we choose to live, physically on or off-the-grid, we are all impacted in positive and negative ways by the immediate condition of the world in which we are living. It is currently much more difficult to see and spend time with our friends and extended families (i.e. to be social), yet it is a lot easier to see a clear blue sky and spend time in a less inhibited nature. For a lot of people it is way more difficult to work and make money, but there is more time available to relax, do nothing, reduce physical stress, and make and create quality memories with our partners and our children, if we so choose. It is virtually impossible to see into the future, whether near or far, while it is almost imperative that we remain fixed within the present moment of Now if we want to preserve our sanities.

I believe we, meaning all of us American Humans (since those are the only ones I have direct experience and knowledge of), are in the middle of a seeming wake-up call in a very critical time right now. Right NOW. Our job is to discover whether it is a valuable and lasting wake-up call, or a brutal and temporary wake-up call. I happen to see us all standing on a pivotal precipice of opportunity during these monumental and historic times. If we decide to take advantage of this opportunity, we will redefine for ourselves the meanings of "success" and "happiness," and make some serious and inherently long-lasting and durable changes in the ways that we choose to live (and love) our lives. If we shun, or choose not to seize the opportunity being provided, we will metaphorically fall off the cliff of the precipice and sink back down to lower levels of unconsciousness and unconscious living patterns that have brought us to the precipice in the first place.

Here in America, most of us have been given the standard templates for living the "successful" life, and they have been ingrained in us since childhood. These "templates" can be neatly summarized or nutshelled using the old expressions "Living the Dream" and "Keeping up with the Jones." Essentially, these templates are characterized by working, earning, buying, consuming, upgrading, single-using, throwing away, doing it all again, doing it more, and starting the process over, again and again and again. Of course, the hidden truths behind this "Dream," which are not fully disclosed to us in the beginning, are debt, unhappiness, and the additional balls and chains of work, credit card bills, mortgages, tuition loans, lack of time, stress, poor health, and unfulfillment, just to name a few.

© Leaf Running-rabbit

These life-sized bronze sculptures are America's most famous Native American Ballerinas called the Five Moons. They were made by Leaf's Uncle, Gary Henson, and are on display outside the Tulsa Historical Society serving as an expression of joy and unconditional happiness.

Though extreme and widely used in our culture, these "templates" are not the only templates one can use or abide by. Over the last decade plus, more and more people have been pushed so far over the line and limit of unfulfillment and lack of purpose they have in their lives that they have started rethinking, and redefining, how they spell out the meanings of success and

happiness for themselves. The first realization is that "success," as historically defined and looked at within our society, i.e. a better job, more money, more expensive clothes, more and more toys, multiple cars, a bigger house, a second house, etc., these things simply do not equal or equate to Happiness with a capital H. Just look at the expression on Ben Franklin's face on a hundred dollar bill for more proof. I do not know of a more epitomized example of distaste, of downright "blah," skepticism, and of just simply being authentically UNimpressed.

Happiness redefined is more in alignment with "value," rather than "success." Value is something inherent, vital, lasting, and meaningful. Value has nothing to do with things, materials, wealth, or anything else that can be taken away from you or lost at any given moment, AND which cannot be taken with you when you inevitably leave this physical realm and continue on your Soul Journey however it is that you personally see and define that. Happiness in this sense is not dependent on material concepts that arguably have no meaning to your Spiritual Self or your Inner Being. Happiness redefined in this way is something that one owns unconditionally and permanently within the core and center of their Being. I would call this a more meaningful, purposeful, inherent, valuable, and unconditional happiness.

Millions of people have been "waking-up" to these unnecessary balls and chains of meaninglessness and *conditional* happiness. Concepts such as Minimalism are being embraced by many who are choosing to create more space and time in their lives for more meaningful experiences and relationships by reducing or getting rid of all the "things" in their lives that have no essential value. Mindless consumption is radically being replaced with mindful awareness and mindful presence, which can be equated to living Life more fully in each and every present moment, the place where many scientists, psychologists, and philosophers have been arguing for years that meaningful and purposeful Life actually exists. (For more and easy research and understanding of these concepts, one can readily search under Deepak Chopra, Sam Harris, Eckhart Tolle, Oprah Winfrey, and countless others on YouTube, in bookstores, on social media, etc.) Even the simple act of meditation alone is known to increase happiness in your life by a minimum of 10%, and one doesn't even have to do it for hardly more than some minutes per day. MINUTES!

So now that I have rambled on long enough that I potentially have robbed you of your only free time to meditate, you are probably asking how this applies to living on or off-the-grid. I would now like to get back to this point.

I can reasonably assume that we, the readers, contributors, and participants of this insightful magazine, *Solar Today*, understand and value the concepts and benefits of off-grid AND on-the-grid solar living: of not only saving, but valuing, our natural resources to the point of sustainability; of using less, not more; of reduce, reclaim, re-use, restore, and recycle; of basic respect and responsibility toward the environment; etc. Right? Otherwise, we would probably not be reading or affiliating with this magazine in the first place. Therefore, I have a proposition for you, for me, for all Americans, and presumably, for all of Humanity:

LET US ALL GO "OFF-THE-GRID," MENTALLY SPEAKING, AND THROUGH MEANINGFUL ACTION.

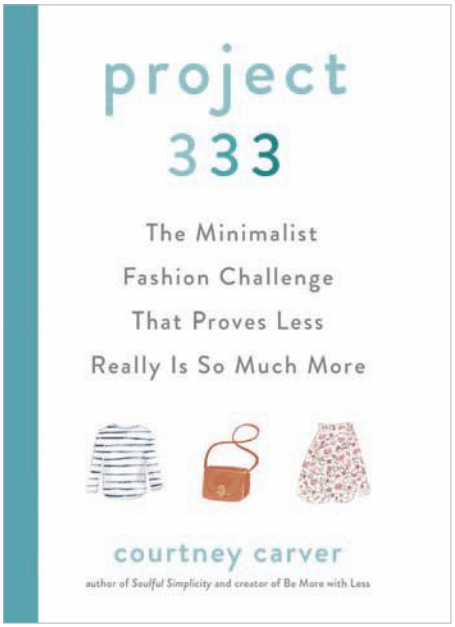
Of course, this proposition has absolutely nothing to do with physically living in a rustic cabin buried in a remote forest or without power lines and no running water. It has everything to do with a new mental framework, a new perspective, and a new attitude of removing ourselves mentally from the American and templated "grid" of consumerism, materialism, and waste-ism, and placing our minds and actions within the redefined grid and realm of value and unconditional happiness through the minimization and elimination of meaningless balls and chains.

In other words, I see the American system of *success over value* as a gridlocked system, meaning we get trapped in the grid of working too much, worrying and stressing too much, and additionally sacrificing too much of the more important values of freedom, wholeness, and happiness. By and large, we are "gridlocked" in a system that has no way out, that is a dead end, and that sorely lacks meaning and purpose. This idea could be summarized by saying that we need to stop chasing (happiness) and start attracting (happiness), or in another way, we need to stop living in tension and start *living with intention*. This new system would be placing *value over success.*

What would this "living off-the-grid mentality" look like?

A good starting point for ideas, in my opinion, is the documentary titled ***The Minimalists*** by Joshua Fields Millburn and Ryan Nicodemus, who promote a happiness-generating and minimalist lifestyle. Another example is the book titled ***Project 333: The Minimalist Fashion Challenge That Proves Less Really is So Much More*** by Courtney Carver, which promotes a minimization of the clothing and accessories we own

and wear. I truly and honestly have no skin in the game of these people's ideas, they are simply examples and great ideas that I think are valuable and worth sharing. But as a member of the human race, and for the purposes of respecting and valuing the climate,



natural resources, and sustainability, as far as collective unity consciousness, as far as unconditional happiness, the skin of my entire body is in the game. And as far as I can see or tell, so is yours.

Additionally, there are further ways that on a day to day basis, we, people who care about sustainability and the environment, can add to and contribute to this new framework of mental "off-the-gridness."

The reduction or elimination of these wasteful, small, and practical daily acts done by us as individuals, and multiplied by the millions (of people), can dramatically reduce consumption, waste, and thoughtless non-intention that cause literal harm to our environment and energy resources. In fact, they become a new and fun game of habit-forming conscious perspective that actually reduces stress by way of having less things to think about, that create and open up space for more meaningful and wholesome actions and relating to the world and environment, and foster and promote what I call "the invention of time," whereby having less things to worry about, less decision-making to attend to, less things to have to clean up, work around, or continuously have to go and buy, we actually create and "invent" time that we can put to better, more meaningful and purposeful use, such as quality time spent with family and friends, creativity, rest and relaxation, or any other myriad of options that literally add value and happiness to our lives.

All of these things, when combined, add new dimensions of value to our lives, which unconditional happiness *from the inside out* becomes a byproduct of. It is a well-known and proven fact, that when we have true and meaningful feelings and thoughts coming from our insides, when we have the gratification of purposeful actions, when we have the wholesomeness of deeper and more loving and quality-filled relationships, and when we have more time for stress-reducing rest, relaxation, and meditation, there are no two ways about it, **we are happier.** Not material and thing happy, but true, powerful, inherent happiness from the inside out, from the core of our very Being. This is what I mean by unconditional happiness, the type of happiness that cannot be taken away by a pandemic, by a crashing stock market, or by meaningless worry.

To finish, I would like to quote Joshua from ***The Minimalists*** documentary. What he said as a way of ending one of his speaking engagements, was "Love people, use things." The way I take the love people part, is that in order to properly and fully love people, including ourselves, we need to have the time, space, and mental availability with which to do it. It is so much harder to do when we are constricted by too many schedules and deadlines; when we are under sheer exhaustion from tirelessly working too much; when we are stressed out from having way too many things to think about; when we have too much house to clean, maintain, and pay for; etcetera. And the way I take the *use things* part, is that if we are not actually and literally using something, we do not need it, whether it be the second, third, and fourth hoody, jacket, or ball cap we own, or a turned on porchlight during the middle of the day. If there are things we own that do not add value to our lives, we should not own them. For some of us, this may mean entire garages and closets full of unused stuff. For others, it could simply mean to turn the lights off and to stop letting the water run. The *use things* part, here, in this sense, means use everything you own, otherwise, if you are not using it, do not own it, do not clutter your life with it, do not clean around it, do not allow it to take a single second of your valuable time. Create space, clear clutter, invent time.

The only other thing I would add to his statement, in closing, is to get happy. It is important. You are important. The environment and our natural resources are important. Unconditional happiness is important. So, by all means: ***Love people, use things, and get happy.*** Unconditionally. ■

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Checking In

By Blake Jones

In an unmistakable sign of continued maturity, Clean Energy Credit Union has announced the availability of checking accounts and debit cards! This long-awaited and much-requested personal banking option will be provided to Credit Union members with no start-up or monthly fees—zippo. The following is a run-down of what new checking account holders can expect right out of the box.

- **Free bill pay,** enabling you to set up one-time payments, schedule future payments, or create recurring payments.
- **1.0% interest** earned on balances up to $15,000 for credit union members meeting qualifying conditions.
- **A shiny new debit card** that provides free cash back at the point of sale and five free in-network ATM withdrawals per month. NOTE: all debit cards are made from bio-based, industrially compostable, polylactic acid (PLA).
- **An overdraft line of credit** that provides qualifying/approved members with a valuable back-stop against overdraft fees when you inadvertently overdraw the account.

And, as with any new product launch, we're already hard at work prioritizing and developing new features for version 2.0. By the end of this year, expect your Clean Energy Credit Union checking account to include mobile payments with Apple Pay, Google Wallet, and Samsung Pay. Card Control, an app-based card security manager, will enable you to configure how, when, where, and whether your debit card can be used.

Clean Energy Credit Union's new mission-themed debit card that was designed by Credit Union member, Sara Slocum

The without-a-doubt-best-part of clearing this hurdle, however, is being able to now revisit the many prospective members for whom lack of checking accounts was a deal-breaker… and to ask them to give us another look. Was that you or someone you know? Where you put your money matters.

Okay. So that's obviously the news we were most excited to broadcast this time around, but it's not the only sign of healthy program development in recent months. We also wanted to mention that a seemingly inexhaustible consumer appetite for clean energy vehicles and green home improvements has inspired us to introduce a new 20–year loan term for residential solar PV and geothermal systems (in addition to our 12– and 15–year terms) and a loan limit increase from $70K to $90K for electric vehicles and residential solar PV and geothermal system projects. Small changes though they may be, both are among the many hopeful harbingers denoting progress against carbon impacts and climate change.

That's a wrap. We look forward to helping you leverage your savings (and now checking) for good. To learn more, please visit cleanenergycu.org. ■

ASES members, as well as members of their immediate family and household, are all eligible to join Clean Energy Credit Union for solar PV loans, EV loans, green home improvement loans, checking, savings, and other banking services.

Fall 2020

25TH NATIONAL SOLAR TOUR

AMERICAN SOLAR ENERGY SOCIETY

SOLAR UNITED NEIGHBORS

in partnership with Generation180

Welcome to the 25th Annual National Solar Tour

September 28th - October 4th

nationalsolartour.org

The National Solar Tour is 100% Virtual!

American Solar Energy Society and Solar United Neighbors host the nation's largest tour of solar buildings virtually.

Due to COVID-19, the American Solar Energy Society (ASES) and Solar United Neighbors (SUN) have converted the 2020 National Solar Tour to be fully virtual. This largest annual grassroots solar event will take place virtually on nationalsolartour.org from September 28th - October 4th, 2020. National Solar Tour week will showcase live programming focusing on electric vehicles, schools, homes, businesses and community building through solar along with virtual tours of solar and sustainable homes, businesses, schools, religious institutions and more. These events and tours will empower people to learn about solar technology and the process of going solar from their neighbors and people nationwide, all from the safety of their home.

2020 National Solar Tour Program Schedule

Subject to Change

Monday September 28 - Electric Vehicle Day

EV Panel

Tuesday, September 29 - Solar Homes Day

Coffee Chat with Solar Owners
All About Solar/Intro to Solar
Going Solar with a Certified Installer | NABCEP
Happy Hour with Solar Owners

Wednesday September 30 - Solar Businesses Day

Solar for Small Business
Solar Businesses and Sustainability Panel

Thursday, October 1 - Solar Schools Day

A Brighter Future for Schools Through Solar
Electrify Your Ride to School
Students Lead the Charge for Solar

Friday, October 2 - Community Building Day

Policy Session | Community Solar
Energy and Equity Panel
Veterans Program | NABCEP
Movie Screening

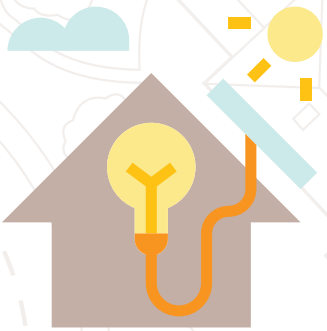
Saturday, October 3 & Sunday, October 4 - Virtual Solar Tours

To learn more and RSVP to get access to the online National Solar Tour, visit nationalsolartour.org.

2020 Local Solar Tours

Check out these Local Solar Tours and more at nationalsolartour.org

Passive Solar Homes by Sun Plans – Various Locations in USA & Canada
Prostruct Solar CEO House Tour – Scottsdale, Arizona
Davis Driving on Sunshine – Davis, California
Denver Metro Green Home Tour – Broomfield, Colorado
Atlasta Solar Center Clean Energy Campus – Grand Junction, Colorado
Chafee County Green Homes Tour Colorado – Salida, Colorado
FREA Solar Tour of Titusville – Titusville, Florida
Heartland Solar Tour – Carterville, Illinois
Solar Planet KS – Shawnee, Kansas
Cohassett, MA Solar Tour and More - Cohassett, Massachusetts
Hingham Solar Tour - Hingham, Massachusetts
South Shore Green Energy Tour – Hull, Massachusetts
Plymouth Solar Tour - Plymouth, Massachusetts
Dearborn Solar Home Tour – Dearborn, Michigan
Lansing Area Solar Home Tour – East Lansing, Michigan
Grand Rapids Area Solar Tour – Grand Rapids, Michigan
SolarYpsi Solar Tour – Ypsilanti, Michigan
MRES Virtual Solar Tour – Minneapolis, Minnesota
Minnesota EV, Solar and Battery Storage Owners – Saint Paul, Minnesota
Sierra Club Croatan Group – Emerald Isle, North Carolina
Ohio "Wish You Were Here" Tour – Mentor, Ohio
Lover Merion Solar Tour - Merion Station, Pennsylvania
Exact Solar's Awesome Customers Tour - Pennsylvania & New Jersey
Chester County Clean Energy Tour - PA - Chester County, Pennsylvania
Tour of National Grid Customers in MA & RI - Rhode Island & Massachusetts
Cool House Tour - Austin, Texas
South Plains Solar Tour – Lubbock, Texas
AbleEasy - McDade, Texas
Solar Tour Waco – Waco, Texas
Harrisonburg Solar Home Tour 2020 – Harrisonburg, Virginia
Hampton Roads Solar Tour – Norfolk, Virginia
Palouse Tour – Palouse, Washington



Sustainability Basics

Geothermal Heating

Geothermal heat pumps (GHPs) can heat, cool, and supply hot water to a home by taking advantage of the Earth's constant underground temperatures.

How does it work?

The sun heats the Earth's surface. This heat is then transferred to water-filled underground popes. This water then goes through a heat pump, which sends headed air into the distribution system.

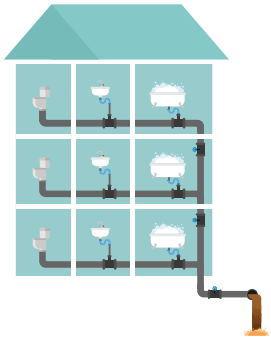
What are my options?

Consumers have several options to consider when selecting a GHP system. The design of a GHP system varies depending on climate, soil conditions, land availability, groundwater accessibility, and local installation costs.

What are some Benefits?

GHP systems are more energy efficient than traditional HVAC systems, lowering your utility bill and reducing peak electricity demands. GHP systems also reduce your carbon footprint thanks to their high efficiency, all while having extremely long life spans!

Sources:
tinyurl.com/y6eg82w
tinyurl.com/y6lvovhe



Greywater system

Greywater is the term coined for water from washing machines, bathroom sinks, and showers, which can eventually be repurposed to conserve water.

What is a greywater system?

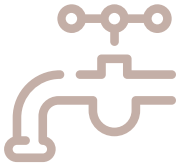
Greywater systems redirect and recycle this "repurposed" water for other purposes. There are many types of greywater systems such as rain barrels, laundry-to-landscape systems, and many others.

What can greywater be used for?

Since greywater contains traces of dirt, food, and grease, it should not be applied directly on vegetable gardens. However, greywater can be used for toilet flushing, to irrigate lawns, ornamental gardens, or trees, or more.

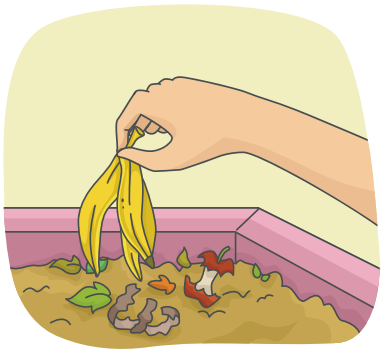
What are some benefits of a greywater system?

Aside from the savings on your water bill, reusing greywater keeps it out of the sewer or septic system, reducing the amount of pollution in local rivers and lakes.



Sources:
tinyurl.com/y2kcsffk
tinyurl.com/y3n2jq7w

Sustainability Basics



Composting

Composting is the process of recycling various organic materials that would otherwise be regarded as waste products.

How does it work?

Organic matter works to break down into nutrients to be absorbed by plants. Composting is a way of aiding in this process by including the right ingredients in the right proportions under optimal conditions

What can I compost?

To maintain a healthy compost pile, it is important to maintain a higher amount of carbon than nitrogen. Carbon-rich matter can include branches, dried leaves, peels, coffee grounds, eggs, and more. Whereas, nitrogen-rich matter can include manure, food scraps, lawn clippings, and more.

Why compost?

Compost can be used as a garden supplement to promote plant growth and soil health, all while reducing the need for chemical fertilizers and pesticides. It also can save time and money by reducing your garbage bills.

Sources:
tinyurl.com/y3rqlogr
tinyurl.com/y6sw6bgk

Gardening

Starting a flower or vegetable garden is both fun and rewarding. Gardening can prevent soil erosion, replenish nutrients in the soil, support wildlife, and reduce your carbon foodprint.

How do I start?

First, you must think about what exactly you want to plant? If you choose to plant vegetables, fruit, or herbs, think about what your family would be willing to eat and what grows best in your climate zone. If you choose flowers, decide whether you want annuals or perennials.

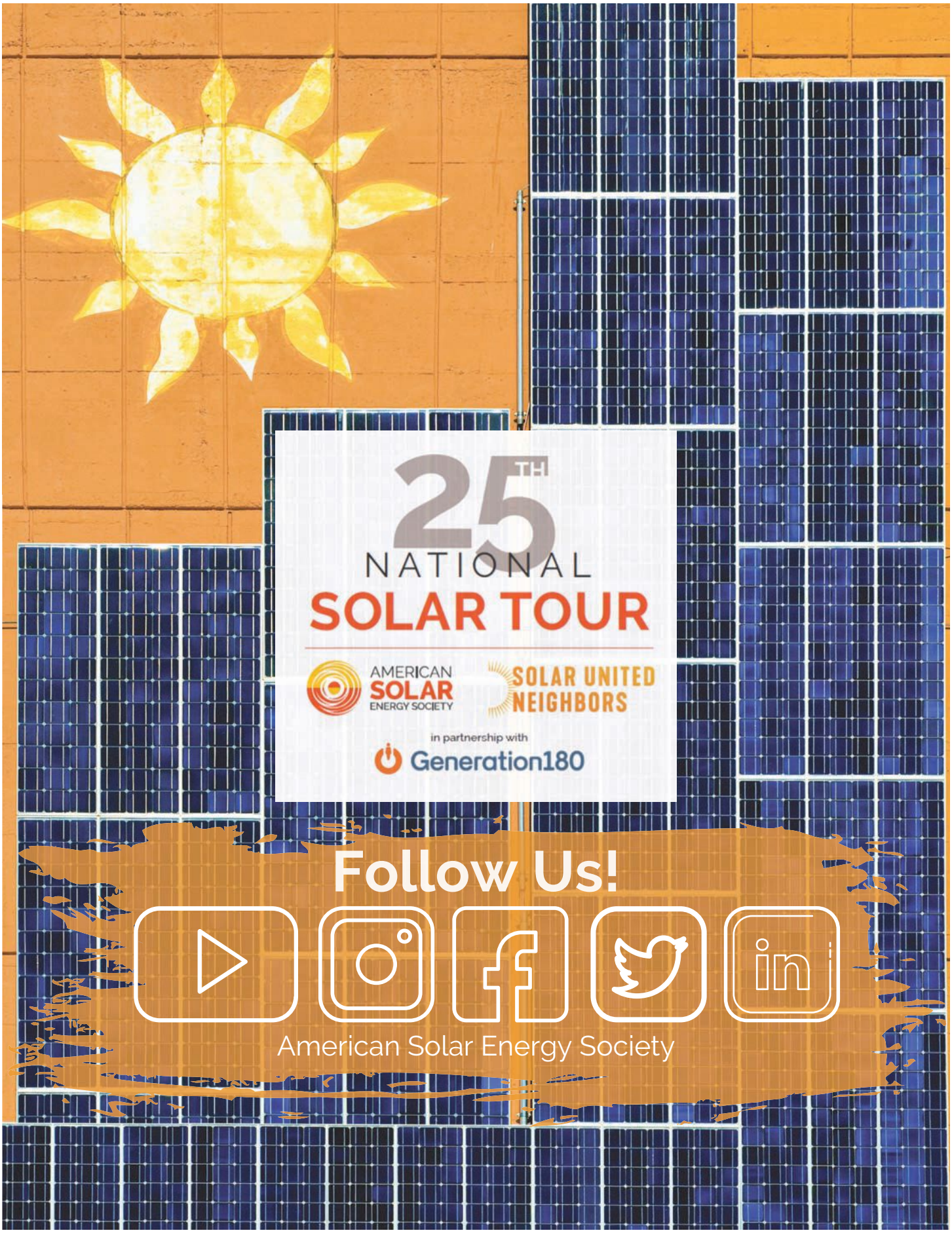
What next?

Once you decide what to plant, it is important to plan your garden beds and location. Almost all vegetables and flowers need 6-8 hours of full sun each day. Make sure to also test and prepare the soil, followed by planting your seeds or transplant.

How do I maintain a garden?

To help your garden reach its full potential, you'll need to water the area, pull weeds, add additional fertilizer, and get rid of dead/dying vegetation. It may be necessary to support tall plants with a trellis, stake, or a tepee.

Sources:
tinyurl.com/y5lbal75
tinyurl.com/y6tsqqp4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SOLAR TOUR
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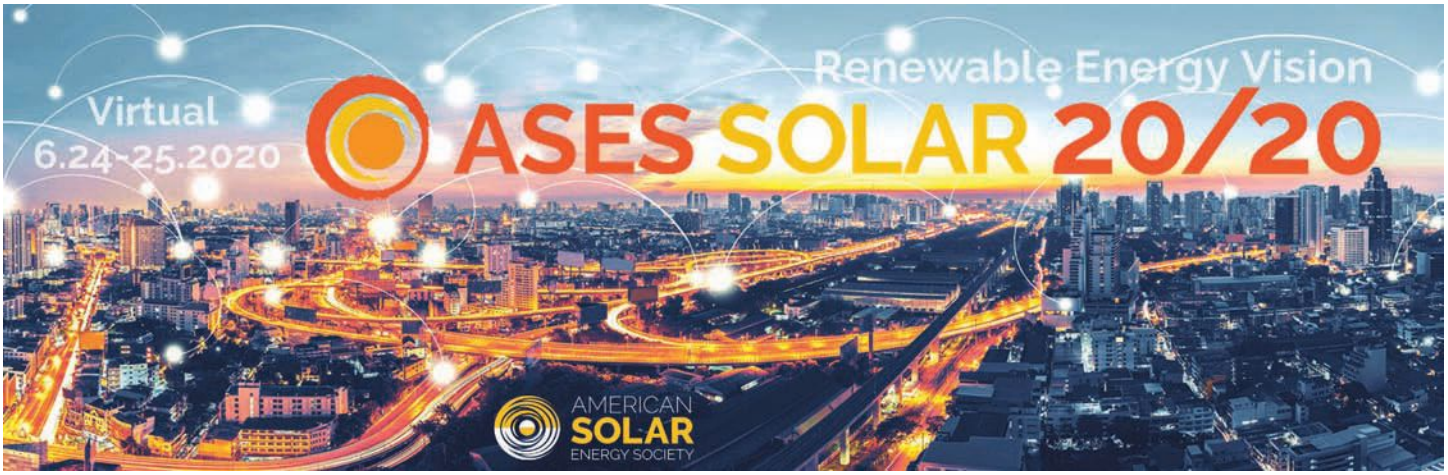
AMERICAN SOLAR ENERGY SOCIETY

JOIN THE ASES MEMBERSHIP DRIVE!

Help us double our membership by August 2021. We are asking each member to bring on one additional member. Gift a membership at ases.org/join or on page 45.

Thank you for your support.



Conference Wrap

SOLAR 20/20: Renewable Energy Vision Calls us to Action

The world has changed and we must change with it, but our ultimate goal – a world run on clean, renewable energy – remains the same. What can we do together to ensure that the current global pandemic doesn't slow, but actually accelerates the transition to a clean energy world? What can we do to better integrate and connect concerns about social, economic, and racial injustice with our ongoing efforts to improve access to clean air, clean water, and clean energy for all? These are key questions that were addressed throughout the American Solar Energy Society's (ASES) first virtual conference, *SOLAR 20/20: Renewable Energy Vision*, on June 24 and 25.

A major outcome of the conference is the Call to Action, #MissionPossible #FossilFreeAndFlourishing. Sign the Call to Action and view conference presentations and posters at ases.org/solar-2020-archive.

A key aspect of achieving the renewable energy vision is gaining public support for actions and policies that will rapidly advance the transformation to 100% renewables. During the kickoff session of the conference, the *Stronger Together Town Hall*, representatives from a wide array of organizations involved in advocacy and policy-making highlighted how we can better work together to grow our constituencies and strengthen our movement to realize our common goals. The two conference keynote sessions, *Clear Vision for Worldwide Action and Citizen Action*, brought together diverse perspectives on global and national climate actions aimed at drawing together policymakers, leaders in all sectors, and advocates to spur change.

The conference featured discussions on advances in buildings, including presentations from 2020 Solar Decathlon Decathletes, systems integration, PV, solar thermal, and storage. Other sessions at SOLAR 20/20 featured discussions on clean energy education, policy, and finance. Special forums included the longstanding Women in Solar Energy (WISE) Forum highlighting women who are leading and inspiring others across the solar industry space, the Emerging Professionals Forum connecting young people new to the renewable workforce

through networking opportunities, and the Spirit and Sustainability Community Forum in which everyone was invited to share their thoughts about how we can move toward a cleaner, healthier, and more equitable society as effectively as possible.

The interactive conference platform provided opportunities for participants to network with each other on a chat platform, engage in live and recorded sessions with dozens of speakers in the live sessions and learn more about conference partners, sponsors, and posters from the Poster Session in the exhibit hall.

ASES invites everyone to sign the Call to Action for individuals and/or your organization/business, which pledges:

- A world run on 100% renewable energy is possible.
- Being fossil-free leads to a thriving economy, planet, and people worldwide.
- Progress to 100% renewable energy is accelerated by working together.

See you August 3-6, 2021 at for **SOLAR 2021** at the University of Colorado, Boulder! ■

SOLAR 20/20: Renewable Energy Vision's virtual lobby and auditorium space.

In August, ASES launched a **NEW** newsletter, the ***Eight-Minute Update*** (the time it takes sunlight to reach the earth). It's a monthly update of our organization, programs, and projects.

We are sensitive to your inbox and have limited the number of emails we send. Please reconnect with ASES by updating your member profile with a current email address, or email membership@ases.org. Thank you for your support.

The power of community

AMERICAN SOLAR ENERGY SOCIETY

ases.org/join
ases.org/renew

Membership and Programs

National Solar Tour

The National Solar Tour shows off solar homes, businesses and schools to educate and empower neighbors on clean energy choices.

Solar Today Magazine

Members receive the quarterly magazine that delivers information on lifestyle trends, technology and analysis to the sustainability community.

National Solar Conference

For 50 years we have hosted the National Solar Conference, a unique blend of science, business, policy and industry.

ASES Chapters

ASES has 37 Chapters, including Student Chapters, doing regional clean energy work. ASES Chapters work together to build a better tomorrow.

ASES Technical Divisions

Access to any Division is open to ASES Business, Professional, Student and Life Members to exchange information and support ASES media and events.

Zero Emissions Network (ZEN)

ZEN provides resources and community grants to help you reduce your carbon footprint.

Monthly Webinar Series

ASES Members receive free priority access our webinars, featuring technology, policy, economics, and other solar and renewable energy information.

Tiny Watts

Members get access to a web-based platform to create a nationwide community of "tiny watts" – very small applications of solar PV and solar thermal.

Clean Energy Credit Union

Members get access to join the Clean Energy Credit Union, a financial institution focused solely on providing loans and investment opportunities in renewable energy and sustainability.

ASES Membership

Sign up for one of our membership options below or on ases.org, and select auto-renew in the payment section for an **extra $10 off!**

AMERICAN SOLAR ENERGY SOCIETY

Basic $45 **Digital Basic $29**

Includes Solar Today magazine, a 15% conference discount, access to CECU, webinars and Tiny Watts

Professional $99 **Professional Senior (65+) $50**

Includes all the benefits of a Basic Membership, a 25% conference discount. plus access to ASES Technical Divisions

Professional Supporting $135

Includes all the benefits of Professional Membership plus annual recognition in Solar Today magazine

Student $35 **Student Digital $22**

Includes the benefits of Professional Membership plus an additional conference discount

Library $59

Includes all the benefits of Basic Membership plus duplicate copies of Solar Today magazine

Business **1-2 employees $195** **3-9 employees $290**
10+ employees $375 **Non-Profit $109**

Includes all the benefits of Professional Supporting Membership plus special online recognition

Life Membership $1,500 **Senior Life Membership (65+) $1,200**

Includes all the benefits of Professional Supporting Membership for LIFE

Add a Local Chapter to Any Membership for $30

Colorado - Northern California - Oregon - Florida - Kentucky - Maine - Mid-Atlantic - Minnesota - New Mexico - New York - Texas

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Name on Account :_____

Account Type:

o Personal OR o Business

o Checking OR o Savings

Account Number: _____

Routing Number: _____

o OR Credit Card

Number:_____

CVV:_____ Expiration Date: _____/_____

Name on Card: _____

Signature: _____

Billing Address: _____

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Please mail this form and payment information to: **American Solar Energy Society, 2525 Arapahoe Ave, Suite E4-253, Boulder, CO 80302**

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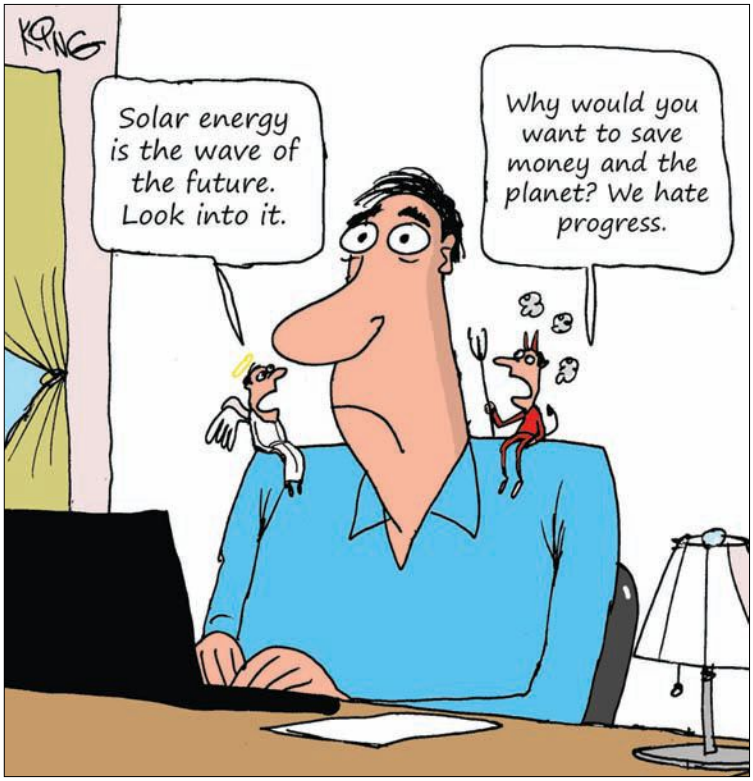
ASES Intern Spotlight

Margaret (Ebee) Ward

Fundraising Campaign and Grants Research intern

Ebee Ward joined ASES as the Fundraising Campaign and Grants Research intern in June 2020. Ebee is from Texas and is a senior at the University of Colorado Boulder. She is majoring in Environmental Studies with a minor in Spanish. While at ASES, Ebee is preparing herself for a career in environmental policy. She is passionate about sustainability and environmental justice and plans to attend law school after graduation. In her free time, she enjoys hiking, snowboarding, and playing with her bunny, Disco.



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