A Bright FUTURE

SOLAR ENERGY IS HERE. It's no longer possible to ignore an energy source that's safe, affordable, reliable, and abundant.

ACROSS THE U.S., SOLAR POWER IS HOT. Photovoltaic solar panels—"PV" to insiders—are taking over new rooftop real estate every day. Solar power plants, both PV and concentrating solar power (CSP), are increasingly generating electricity on an industrial scale. And solar heating and cooling systems (SHC) are gaining popularity nationwide. With the clamor for renewable energy growing and falling costs bringing it into fossil-fuel range, solar is not likely to cool down soon.

By the end of 2014, solar energy from all sources will produce sufficient electricity to power 3 million American homes—enough to effectively handle the combined power needs of every home in Alaska, Delaware, Hawaii, Maine, North Dakota, South Dakota, Rhode Island, Vermont, and Wyoming. So says Rhone Resch, president and CEO of the Solar Energy Industry Association (SEIA), a national trade organization whose members research, manufacture, distribute, finance, and build solar energy projects.

Like most technology ventures in developmental phases, solar has commanded a premium over standard power sources delivered on a massive scale. But times are changing: An average PV system costs 40% less today than at the start of 2011, according to SEIA, and recent research from Deutsche Bank concludes that price competition already exists in 10 states. In Hawaii, where sunlight is abundant and utilities charge hefty fees, solar consumers can slash monthly electric bills from $250 to a $17 minimum utility customer charge, says Steve Godmere, co-founder of Hawaii Energy Connection, one of the state's leading installers.

According to Josh Goldberg, co-founder and EVP of Maryland-based Astrum Solar, the current all-in cost for solar power, including installation, is 13 cents per kilowatt-hour over its lifespan. In Connecticut, a Northeastern state with high energy costs, homeowners paid utilities 17.6 cents per kilowatt-hour in August 2013, according to the U.S. Energy Information Administration. At that rate, experts say solar should pay for itself in six years for customers who purchase their systems.

"The cost objection is becoming moot," says Jeff Lyng, a senior policy adviser at the Center for the New Energy Economy at Colorado State University. According to SEIA, a record-breaking 23 million solar

SEIA Solar Energy Industries Association®

GAME CHANGER

Offering solar power as a consumer product, **Enphase Energy** has given the industry a refreshing new look.

Main Street Power has put Enphase technology to work at 125 buildings in the San Diego Unified School District.

Image courtesy of Main Street Power

EVER SINCE THE NASA SPACE PROGRAM introduced consumers to solar panels, turning sunlight into electricity has attracted the attention of the brightest scientists and entrepreneurs. Environmentalists have given solar another strong push, but one key element has been lacking: the efficiency and user-friendliness needed to win a mass market.

That gap was filled in 2006 when Enphase Energy arrived on the scene. Enphase approaches solar power as though it were a consumer product—much like a refrigerator, computer, or any household appliance—but one that produces energy. The end game, says CEO Paul Nahi, is simple: Buy it, bring it home, and plug it in—all of which is easily feasible because Enphase turns over the installation of its solar systems to roofers, homebuilders, and even do-it-yourselfers.

"The Enphase DNA is deeply embedded in Silicon Valley," says Nahi. Like fellow co-founders Ragu Belur and Martin Fornage, Nahi cut his teeth on high-tech startups. "Our business model looks very much like Apple, Cisco, or any semiconductor-based company," he says.

The Enphase System is centered around the company's patented microinverters, which convert the sun's energy from individual solar panels into usable electricity in homes, businesses, and on the electrical grid, giving Enphase customers unparalleled insight into the energy they produce. To date, Enphase has shipped more than 4 million microinverters to customers in 11 countries across Europe, North America, and the Asia Pacific region, and is the No. 1 inverter technology used in residential solar installations in the Americas.

Enphase products emphasize user-friendliness. Its microinverters allow computers, tablets, and mobile phones connected to the Internet to monitor solar output and provide perspective. Customers can compare current performance against what happened the previous day, week, or month, and can view output under different weather conditions. A status indicator reports on system health and issues that may affect performance.

Enphase technology also makes expanding an existing solar system easy—customers can start with a modest system size and add to it as their energy needs change.

"The Enphase core product was a game-changer in the industry," says Chris DeBone, co-founder of Hawaii Energy Connection. "Solar can now be deployed in a mass way that increases production and the visibility of system performance." Since 2008, Hawaii Energy Connection has installed some 5,000 Enphase microinverter arrays, says DeBone, and demand continues to accelerate.

"The value proposition is clear," says Enphase CEO Nahi. "We must enable end users to get a better return on their solar investment." As word of solar spreads and the price of fossil fuel energy rises, the equation only gets better. Technology keeps racing ahead; to make that point, Enphase recently introduced its fourth generation of microinverters.

Growth has matched bullish expectations, with one single departure from his experience in the high-tech sector, says Enphase co-founder Ragu Belur, vice president of products and strategic initiatives: The difference is scale. "At the time, telecom seemed like a big industry," Belur says. "But looking back, it is tiny compared to the energy sector." Where telecom is measured in hundreds of billions of dollars, says Belur, energy is measured in trillions. "When I think about the potential for solar, I say, 'Wow.'" •

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panels will be installed nationwide in 2013—up more than 25% from the 2012 total.

Despite its pluses, solar has some limitations, the biggest being that it can produce energy only during daylight. To deliver power at night requires safe and reliable storage, an area the industry is working to improve. In addition, solar panels require cadmium, lead, and other toxic materials that mobilize environmental groups, and some installations face thickets of permits and red tape at federal, state, municipal, and even neighborhood levels.

Notwithstanding these caveats, solar power is poised to take off. "The technology is there," says Brian Lips, a senior analyst with the Database of State Incentives for Renewables & Efficiency, a research group housed at North Carolina State University with support from the U.S. Department of Energy (DOE) and the North Carolina Solar Center. "It's just a matter of lowering barriers to allow solar technology to get into the space and operate."

Toward that end, the DOE unveiled the Rooftop Solar Challenge in 2012, an initiative that aims to help homeowners and small businesses that want to install solar systems by streamlining, standardizing, and digitizing administrative processes. "Consumers are becoming aware it's a real option," says Amit Ronen, director of the GW Solar Institute of the Trachtenberg School of Public Policy at George Washington University.

Although credits for solar installation costs are due to expire in 2016, solar will do just fine on a level playing field, says Paul Nahi, CEO of Enphase Energy, a pioneer in semiconductor-based microinverter technology for solar installations around the world. "Get rid of all energy subsidies," Nahi advocates, "and let markets decide." He'll bet on solar.

Launched in 2006, Enphase recently unveiled its fourth-generation microinverters which convert direct current into alternating current from each solar panel in an array. This process maximizes the efficiency of solar panels, lowering costs and lifting the return on solar investment—with or without tax incentives. Its low-voltage solutions also facilitate installation by roofers, homebuilders, and even homeowners.

The front line in the solar battle may well be net metering, a system under which consumers pay the difference between the electricity they draw from the grid and the solar electricity they generate. If solar kilowatts exceed conventional kilowatts, consumers pay nothing and get a credit applied to the next month.

Net metering competes with the cost of a grid that furnishes power during nighttime hours, under heavy cloud cover, or if solar systems need repair. As solar proliferates, utilities lose revenue required to keep grids operating. They seek compensation, especially investor-owned utilities that serve customers and shareholders. New regulations in California address net metering by allowing utilities to impose a $10 fee on every electric bill.

Similar regulations are winding their way through other state legislatures, all aimed at making it possible for new and old forms of power to coexist. It isn't a partisan issue, says SEIA spokesman Ken Johnson. Like 90% of Americans who reportedly favor the expansion of solar energy, policymakers cannot ignore energy that is safe, affordable, reliable, abundant, and not vulnerable to political climates in oil-producing nations. Its future is bright. ●