

24/7 Electricity Produced by Intermittent Power Requires Its Energy Storage

Jerry M. Woodall

Electrical and Computer Engineering Department at UC Davis

This is a simple story with a no-brainer punchline included in the title. Except for geothermal and nuclear energy, *the sun is, and has been, the source of nearly all energy used on our planet*. The problem is that the earth receives plenty of *intermittent solar power*, but not as solar *energy*. Solar intermittency was not a problem before the industrial revolution, when human daily energy needs were only 1.5-2.0 kWh. The intermittency problem came with the emergence of iron and steel production, industry, and fuel powered transportation. It is important to stress is that *daily sun power did not enable the Industrial Revolution*. Rather, it occurred as the result of the availability of energy storage materials created by the death of life created by intermittent solar insulation over millions of years.

In retrospect, using fossil fuels, rather than using daily solar insulation, to launch and develop our current enormous energy consuming and data driven society was a human tragedy. We are now faced with two daunting global scale energy creation and distribution issues. One is having to legislate use restrictions for societies with opulent life-styles. This is a dangerous ploy because the “haves” will not be eager to give up what they already have. The other one is that, owing to instantaneous global communication, the “have nots” will “vigorously” demand energy parity.

After all the low hanging “energy conservation” fruit is picked, what’s next? Resources are available to realize a “greatly reduced fossil fuel” solution to satisfy future disparate societal demands for energy. The sun is free. Less than 10 minutes of solar insulation will create a year’s worth of global energy needs. Capitalization costs of solar cells and wind turbines make them non-competitive with fossil fuel. However, a long-life use factor amortization could bring solar power economics into parity with fossil fuels. The principal remaining issue is to mitigate the sun’s intermittency. *This simply requires economical energy storage of wind and solar power*.

Finally, there is plenty of fossil fuel to supply world-wide energy needs for the foreseeable future. But there are many reasons to stop using fossil fuels for energy and to get on with converting daily solar power into 24/7 electricity. An important one is that global scale conversion of solar power to electricity via storage does not raise earth’s temperature!

Biography:

Jerry M. Woodall, a National Medal of Technology Laureate, and Distinguished Professor of Electrical and Computer Engineering at UC Davis, received a B.S. in metallurgy in 1960 from MIT. In 1982, he was awarded a Ph.D. in Electrical Engineering from Cornell University. He pioneered and patented the development of GaAs high efficiency IR LEDs, used today in remote control and data link applications such as TV sets and IR LAN. This was followed by the invention and seminal work on gallium aluminum arsenide (GaAlAs) and GaAlAs/GaAs heterojunctions used in super-bright red LEDs and lasers used, for example, in CD players and short link optical fiber communications. He also pioneered and patented the GaAlAs/GaAs heterojunction bipolar transistor used in, for example, cellular phones. Also, using the technique called molecular beam epitaxy (MBE) and the GaAs/InGaAs strained, non-lattice-matched heterostructure, he pioneered the “pseudomorphic” high electron mobility transistor (HEMT), a state-of-the-art high speed device widely used in devices and circuits including those found in cellular phones. More recently he invented, developed and published a breakthrough global scale “green” energy storage technology in which bulk aluminum rich alloys split both fresh water and salt water into hydrogen gas on demand, thus obviating the need to store and transport hydrogen. This technology promises to be a serious contender for a long haul, global scale, economically viable, alternative green energy solution.

His efforts are recorded in over 350 publications in the open literature, and 85 issued U.S. patents. His accomplishments have been recognized by his election as IBM Fellow in 1985, an \$80,000 IBM Corporate Award in 1992 for the invention of the GaAlAs/GaAs heterojunction, and the 2001 National Medal of Technology awarded by the President of the United States. He is a fellow of AAAS, NAI, APS, IEEE, ECS, and AVS. His national professional society activities include President of the ECS (1990), and President of AVS (1998).