

Traveling the Path of Least Resistance: SUPERCONDUCTIVITY

Redirecting the Future of Electric Power

It's coming! A technology is nearing the market with the potential to revolutionize the way we generate and receive electricity—to create a superhighway for electricity much like what fiber optics did for the telecommunications industry. It's called high temperature superconductivity (HTS) and, although no new kid on the block, only recently did it move from the realm of imagination to a place of realistic market potential.

What can superconductivity do?

Conserve energy! A staggering 7.34% of energy generated gets lost in transmission through heat losses and other circumstances—energy that never makes it to its destination. HTS could cut this loss in half!

Protect the environment! Superconductivity will help lessen greenhouse gas emissions thought to contribute to climate change, and will save billions of dollars in energy bills—contributing to both the economy and the environment. In addition, HTS power equipment itself will be more environmentally friendly, containing no flammable oil for coolant or insulation.

Save dollars! When superconducting materials become a standard component for electrical equipment and are fully integrated into the electric generation and utility sectors, the technology is expected to save us \$8 billion per year in reduced energy loss. An additional \$8 billion can be saved with the installation of superconducting transformers and electric motors. That's a savings benefit total of \$16 billion per year from the full implementation of currently envisioned HTS electric power equipment! Utilities will have the opportunity to pass savings on to you, the consumer.

Superconductivity Defined

Superconductivity, is the ability of certain materials to conduct unusually large amounts of electricity without electrical resistance loss, is a property inherent to particular metals and ceramics, similar to magnetism in other materials, although superconductivity is reached only at certain temperatures.

Electrical resistance can be explained by looking at one appliance that depends on the presence of resistance. In the case of a toaster, electricity is conducted through wires made of material known to resist electric current, generating the desired heat. In the transmission of electricity along the electric grid system, this same resistance, or escaping heat, equals a critical loss of energy and dollars. Superconductivity will significantly cut these losses.

There are two kinds of superconductivity—low and high temperature. LTS materials become superconductive at temperatures below -411°F (27 K) expensive to cool and maintain. HTS materials become superconductive at higher temperatures (still quite cold) and can be cooled and used more affordably and reliably. Superconductivity products being developed today are primarily HTS technologies.

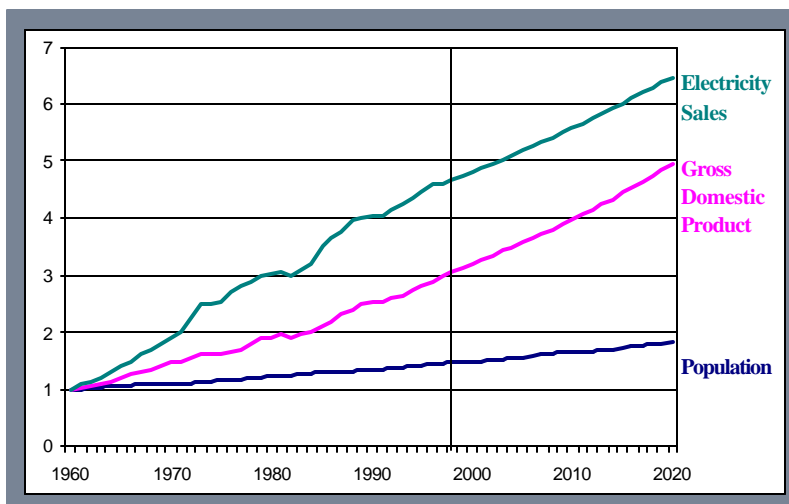
POWER TO THE PEOPLE - BUT HOW?

Clean and Safe New Transmission Technologies Needed in the 21st Century

As the U.S. electricity market becomes fully competitive in the 21st century, consumer demand is predicted to soar. This power will be transmitted across new and frequently changing transmission routes as consumers change their electricity suppliers. However, our electricity grid is already strained to its limit, as blackouts and brownouts occur with increasing frequency throughout the country.

How will we be able to accommodate the rigorous new demands of a competitive market without constructing a massive new electrical infrastructure throughout the country? Due mainly to environmental concerns, new rights of way for transmission lines are very controversial and difficult to obtain, whether through wilderness areas or through densely populated urban centers.

Future Electricity Sales Expected to Outstrip Population and GDP Growth



Growth in electricity sales is expected to far outstrip the growth in our country's population and gross domestic product in the next 20 years. (Index, 1996=1) Source: EIA

Did you know?

According to authoritative estimates, HTS products could potentially save an accumulated 619 million tons of CO₂ through 2020, equalling 169 million tons of carbon. HTS products could also save 776,000 tons of NO_x and 1,646,000 tons of SO₂ emissions through 2020.

Did you also know?

The economic potential of HTS is expected to be huge, with a predicted market of several billion dollars per year by 2020. Likewise, the energy and environmental benefits will be significant and beneficial, with HTS projected to offset the emissions of 40 medium-sized conventional generation plants.

High-temperature superconductivity (HTS)

technology can replace present grid segments with greatly enhanced capacity, thereby giving the grid more flexibility and the ability to accept more generation. Furthermore, the increased efficiency in generation, transmission, distribution and storage of electricity through use of HTS means that less electricity will need to be generated in the first place to supply the same demand.

These greater efficiencies could also allow electricity providers to generate more power from renewable sources of energy such as wind, solar, geothermal, biomass and small hydro-power. Using conventional transmission technologies, tapping some of these clean-energy resources has not been feasible due to their relative remoteness from population centers. The clean, nearly loss-free potential of HTS is an excellent match for America's abundance of clean and inexhaustible renewable energy technologies. New economic opportunities would also be huge, as companies race to incorporate HTS into their grids, much as the telecommunications industry has been doing with fiber optics.



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