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Infrastructure Benefits from Superconductors

The nation's infrastructure has been neglected for several decades which is having an increasing impact on both businesses and individuals. Within the past 25 years major advances in technology have occurred, and have been demonstrated effective, that can recapture U.S. leadership and stimulate the economy. The opportunity exists to create a vastly improved and much more efficient electric power grid, and to provide high speed rail transportation rivaling Japan, Germany, Korea and China.

The U.S. Power Grid is estimated to require investment of $100 billion over the next 10 years to achieve and maintain acceptable levels of electric power reliability. The grid today is inefficient (8% of the power put in is lost to resistive heating which is the equivalent of 40 large coal or nuclear plants and represents 220 million tons of carbon dioxide emissions); outages per year greatly exceed those for other nations, e.g. Japan and France, in number and duration; capacity is near saturation and demand is expected to increase by a further 50% by 2030.

High Temperature Superconductor (HTS) wire for transmission and distribution cables enable much higher power to be moved at significantly lower voltages with exceptionally low loss. Short lengths of such HTS cables have been successfully demonstrated in the grid. More evaluation and investment is needed to move this technology to full commercial status.

Severe power surges caused by lightning strikes, fallen tree limbs, traffic accidents, and other random events pose risk to generators and other equipment in the system. HTS Fault Current Limiters (FCLs) provide a unique solution to this challenge as the superconductor can switch almost instantly from a conductor to an insulator when the power surge occurs and revert automatically to a conductive mode when the surge is passed. This protects downstream equipment and homes and makes for fewer outages. Several superconducting FCLs are in evaluation in the grid.

HTS transformers are smaller, more efficient, and environmentally friendly by eliminating the oil-coolant used in conventional transformers. This substantial reduction in size and weight makes HTS transformers the only option in high power wind energy generation.

Magnetically Levitated Trains (Maglev)**:** Several countries in Asia and Europe rely heavily on rail transportation to carry large numbers of passengers. For longer haul express routes, rail transportation has the advantage over air travel as it typically operates from a transportation hub in the city center. Magnetically levitated trains, employing superconducting magnets, offer a way to make trains literally "fly" to their destinations as the powerful magnets cause them to float above their guideway, or track. Superconducting Maglev trains have attained speeds in excess of 500 kmph. Superconductor magnets are essential to this application because of their dramatically lighter weight and lower power requirements. Superconducting Maglev could revolutionize transportation in the 21st century.

Additional Information**:** For additional information please contact Dr. Alan Lauder, Executive Director, CCAS, at 610-388-6901 or alauder@comcast.net